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THE JOURNAL OF
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# Graded Opposites and Analogies Tests

M. J. VAN WAGENEN

*University of Minnesota*

OCCASIONS frequently arise in connection with vocational testing and in laboratory experiments where several tests of the same type and of approximately the same degree of difficulty are desirable. To meet just such a circumstance it was found necessary to devise a series of opposites tests and a series of analogies tests of approximately equal difficulty and having a fairly high degree of correlation with one another within the same series.

The initial stage consisted in the preparation of a list of some three hundred sets of analogies. These were given to 142 sixth and seventh grade pupils and also to 122 college juniors and seniors. At the same time a list of about the same number of stimulus words were prepared as a basis for the construction of the opposites tests and given to 148 sixth and seventh grade pupils and to 54 college juniors and seniors. The stimulus words for the opposites tests and the sets of stimulus words for the analogies tests were given orally in sets of fifty each. The subjects were allowed a constant time in which to think of and write down the responses on blanks especially prepared for the purpose. The relative degrees of difficulty of the tasks were thus determined on the basis of the frequencies with which adequate responses were given when the time was kept constant. In the case of the opposites material the stimulus words were given at the rate of four seconds each, which allowed just a little less than four seconds for thinking of and writing down the opposite thought of. With the list of analogies the three stimulus words were read one second apart, which gave three seconds for thinking of and recording the response. In order to eliminate any undesirable effects of practice or fatigue the stimulus tasks were given in different orders to different groups. Also adequate rest periods were

provided between each of the several lists of fifty stimuli to insure a maximum degree of effort throughout the whole series.

After all the responses to each stimulus word or set of stimulus words had been assembled they were mimeographed and submitted to thirteen students in an advanced class in educational psychology to be rated for the degree of correctness or adequacy. The judges were instructed to give full credit to all responses considered fully adequate; to those considered only partially correct a half credit was to be given; and to those considered inadequate no credit was to be assigned. On the basis of the ratings of these thirteen mature people the adequacy of the several responses to each stimulus word or set of stimulus words was determined in the following manner. A response was accepted as an adequate response if at least nine of the thirteen judges considered it as wholly adequate. Those responses which were judged as at least partially correct by not less than nine of the thirteen judges were given one-half credit. All other responses were assigned zero credit.

The next step was to give each stimulus word or set of stimulus words a value based upon the frequency with which the adequate and partially adequate responses were given by the different groups of subjects. Inasmuch as the easier stimulus words or sets of stimulus words were for the most part too simple for the college students, only a small degree of discrimination was evident on the basis of their responses. The same was true of the more difficult stimulus words and sets of stimulus words in the case of the elementary school children. To obtain a more reliable evaluation of the relative difficulties of the stimuli the frequencies of the sixth and seventh grade responses were weighted or multiplied by three in the case of the simpler stimuli, and by two in the case of those of medium difficulty. At the same time the frequencies of the college students' responses were multiplied by three for the more difficult responses and by two for those of medium difficulty. After the weightings had been made, the weighted frequencies of the two groups were combined and a final value assigned to each stimulus word or set of stimulus words. The stimulus words for the opposites tests and the sets of stimulus words for the analogies tests were then arranged in tables according to their relative degrees of difficulty.

Before proceeding further in the construction of the tests it seemed essential to discard from the two series all stimulus words or sets of stimulus words which would be noticeably displaced if the weightings used were either changed or even dropped. This process eliminated those stimuli which were disproportionately easier for the younger group of subjects than for the older group or disproportionately more difficult for the more mature group of subjects than for the less mature group. At the close of this sifting process the remaining stimulus words and sets of stimulus words were arranged into four series so that each series presented practically the same degree of difficulty at each step. At a very few places it was necessary to use the same stimulus word in two different series. The final result was four series of fifty stimulus words for the opposites tests and four series of fifty sets of analogies, each series of approximately the same difficulty at each step and ranging from very easy stimuli to stimuli difficult enough to tax college students.

After the four series of opposites and analogies tests had been printed and labeled A, B, C, and D respectively, they were given to about 150 high school sophomores to determine the relative difficulty of the several series. In order to compensate for any influence of practice or fatigue the tests were given in different orders to different sections of the Sophomore group, one fourth being given the tests in the order A, B, C, D, a second fourth in the order B, C, D, A, a third fourth in the order C, D, A, B, and the fourth group in the order D, A, B, C. As a result of this trial it was found that series A, B, and C were of approximately equal difficulty at the 25-percentile point, at the median, and at the 75-percentile point, the variations being not more than two adequate responses. The fourth set, the D series of opposites and the D series of analogies, were somewhat more difficult than the other three series, varying by as much as six adequate responses. The D series have been included, however, as they may be of use even though not of the same approximate difficulty as the other series.

By taking the consecutive tests where they followed each other in the same order it was possible to determine the correlations between each pair of tests of the same type on the basis of approximately seventy-five scores without any interference due to the effects of practice. For the four analogies tests the intercorrelations ranged from +.83 to +.89, while for the four opposites tests the inter-

correlations ranged from +.68 to +.76. By using all four tests fairly reliable measures of the ability to do the opposites tasks and of the ability to do the analogies tasks may be obtained. The combined scores of the four opposites tests would, according to the formula of William Brown, give a correlation of +.91 with the combined scores of four similar opposites tests. The scores of the four analogies tests combined into single scores would yield a correlation of +.96 with the scores derived from four similar analogies tests.

In the sections that follow are given the directions used in giving these tests to the sophomore high school students and to other groups of individuals, including high school freshmen and college sophomores, the four series of analogies followed by the keys, and the four opposites tests with their keys. A response preceded by a 2 in the keys should be allowed full credit. When a 1 precedes the response only one-half credit should be given. All responses preceded by a 0 should receive no credit. Although from fifty to two-hundred-fifty responses were assembled for the greater part of the stimulus words or sets of stimulus words, other responses may be expected. The responses given in the keys will, however, allow such additional responses to be evaluated with a high degree of accuracy.

The following set of directions appeared on the front page of each set of tests, the set consisting of one analogies test and one opposites test:

ASSOCIATION TESTS A.

DIRECTIONS

Do NOT open or turn over this paper until told to do so. The instructor will tell you when to open the sheet and when to turn to page 4.

Fill out these blanks and read the directions that follow them.

Name .....Sex .....Age .....
Years Months

School .....Class .....Date .....

---

On pages 2 and 3 you will find 50 groups of three words each followed by a blank space. In these blank spaces you are to write a fourth word which has the same relation to the third word of the group as the second word has to the first word of that group. The following are samples:

| | | | | |
|---|---|---|---|---|
| color | — | red | name | *JOHN* |
| page | — | book | handle | *KNIFE* |
| chew | — | teeth | smell | ..... |

On page 4 you will find a list of fifty words followed by blank spaces. In these blank spaces you are to write words that mean exactly the opposite of the printed words. The following are samples:

| | |
|---|---|
| hard | *SOFT* |
| bravery | *COWARDICE* |
| long | ..... |

If you do not think of the proper word in any case within ten seconds go on to the next group or word.

Do NOT open or turn over this paper until the instructor tells you to do so.

These directions were read to the subjects, as they read them silently, as far as through the samples for the analogies, sufficient time being given them to fill in the blank spaces. Care was also taken that each subject understood just what to do before proceeding with the test. The note at the bottom of the page was then read, and the subjects were further told: "When I say start, open the sheet to page 2, begin with task number 1, and go as far as you can before time is called, at which signal you will turn back to the first page again. When you have finished through the 25th on page 2 go at once to the 26th task at the top of page 3. Ready, start!" At the end of four minutes the subjects were told "Stop. Turn back to the first page, and beginning just below the middle of the page, read the directions." These were read with the students as before, care being taken that each subject comprehended the nature of the tasks to be done. At the close they were told, "When I say start, turn to the back page, page 4, and beginning with number 1, go as far as you can before time is called, at which signal you will again turn back to the first page. Ready, start!" At the end of four minutes the subjects were told "Stop. Turn back to the first page again."

In the case of all groups of subjects it is advisable to ask the group what other words can be used in the case of the first two samples. If any wrong responses are given the error in the response should be clearly pointed out. The responses to the third sample should be written on the board and all errors made clear before beginning work on the test itself. For elementary school pupils of grades five to eight and for high school pupils four minutes should be allowed for each test. For freshman and sophomore college students three minutes is sufficient time, while two and a-half minutes is adequate for college juniors and seniors.

KEY TO ANALOGIES A

| | | | |
|---|---|---|---|
| 1. | summer — hot | winter | 2—*cold*; 0—*cool*. |
| 2. | sun — shines | wind | 2—*blows*; 1—*howls*; 1—*chills*. |
| 3. | emerald — green | ruby | 2—*red*. |
| 4. | cats — scratch | bees | 2—*sting*. |
| 5. | cup — saucer | knife | 2—*fork*; 0—*blade*. |
| 6. | light — day | dark | 2—*night*. |
| 7. | birds — fly | fish | 2—*swim*; 1—*swimming*. |
| 8. | write — stories | draw | 2—*pictures*; 1—*maps*. |
| 9. | chair — wood | stove | 2—*iron*; 2—*steel*; 2—*metal*. |
| 10. | father — son | mother | 2—*daughter*. |
| 11. | potato — vegetable | veal | 2—*meat*; 1—*flesh*. |
| 12. | food — eat | books | 2—*read*; 2—*study*; 0—*learn*. |
| 13. | barn — hay | library | 2—*books*. |
| 14. | clothes — tear | dishes | 2—*break*; 2—*crack*; 1—*smash*. |
| 15. | thermometer — temperature | clock | 2—*time*. |
| 16. | water — drink | air | 2—*breathe*; 2—*breath*; 2—*inhale*. |
| 17. | light — dark | dry | 2—*wet*; 1—*moist*; 1—*damp*. |
| 18. | July — month | Friday | 2—*day*. |
| 19. | hair — black | eyes | 2—*blue*; 2—*brown*; 2—*black*; 2—*gray*. |
| 20. | man — husband | woman | 2—*wife*. |
| 21. | daily — newspaper | monthly | 2—*magazine*; 2—*periodical*. |
| 22. | pencil — write | broom | 2—*sweep*; 1—*brush*. |
| 23. | lamp — oil | stove | 2—*coal*; 2—*wood*; 2—*gas*. |
| 24. | fat — heavy | thin | 2—*light*. |
| 25. | fast — fastest | great | 2—*greatest*; 0—*greater*. |
| 26. | factory — workman | store | 2—*clerk*; 1—*salesman*. |
| 27. | sparrow — bird | mosquito | 2—*bug*; 2—*insect*. |
| 28. | air — birds | water | 2—*fish*; 0—*duck*. |
| 29. | water — glass | coffee | 2—*cup*; 0—*pot*. |
| 30. | chalk — white | carbon | 2—*black*. |
| 31. | sight — blind | hearing | 2—*deaf*; 1—*deafness*; 0—*dumb*. |
| 32. | ounce — pound | inch | 2—*foot*; 0—*yard*; 0—*feet*. |
| 33. | far — near | there | 2—*here*. |
| 34. | opaque — wood | transparent | 2—*glass*; 2—*water*. |
| 35. | hat — head | shoe | 2—*foot*; 2—*feet*. |
| 36. | after — before | earlier | 2—*later*; 1—*late*. |
| 37. | bread — flour | candy | 2—*sugar*; 2—*glucose*. |
| 38. | work — problems | play | 2—*games*; 1—*ball*; 1—*dolls*. |
| 39. | live — die | life | 2—*death*; 0—*dead*. |
| 40. | month — week | day | 2—*hour*; 0—*minutes*. |
| 41. | linen — cool | wool | 2—*warm*; 1—*hot*. |
| 42. | city — mayor | state | 2—*governor*; 0—*president*. |

| | | | |
|---|---|---|---|
| 43. | present — known | future | 2—*unknown.* |
| 44. | complex — difficult | simple | 2—*easy.* |
| 45. | slipper — shoe | cap | 2—*hat;* 0—*bonnet.* |
| 46. | mail — write | telephone | 2—*talk;* 2—*speak.* |
| 47. | happy — laugh | sad | 2—*cry;* 2—*weep;* 1—*crying;* 1—*sigh;* 1—*moan.* |
| 48. | cheap — many | costly | 2—*few;* 1—*rare;* 1—*scarce.* |
| 49. | picture — frame | field | 2—*fence.* |
| 50. | victory — defeat | success | 2—*failure.* |

## Key to Analogies B

| | | | |
|---|---|---|---|
| 1. | year — month | week | 2—*day.* |
| 2. | work — day | sleep | 2—*night.* |
| 3. | vinegar — sour | sugar | 2—*sweet.* |
| 4. | eat — food | wear | 2—*clothes;* 2—*clothing;* 2—*garments;* 1—*dress;* 0—*cloth.* |
| 5. | horn — blow | bell | 2—*ring;* 2—*tinkle;* 2—*toll.* |
| 6. | rain — summer | snow | 2—*winter.* |
| 7. | rose — bush | oak | 2—*tree.* |
| 8. | country — road | city | 2—*street;* 2—*avenue;* 0—*pavement.* |
| 9. | high — low | near | 2—*far.* |
| 10. | iron — heavy | aluminum | 2—*light.* |
| 11. | stove — heat | lamp | 2—*light;* 1—*illuminate.* |
| 12. | front — back | top | 2—*bottom.* |
| 13. | delicious — taste | fragrant | 2—*smell;* 2—*odor.* |
| 14. | Boston — city | Kentucky | 2—*state.* |
| 15. | navy — sailors | army | 2—*soldiers.* |
| 16. | raise — lower | open | 2—*shut;* 2—*close.* |
| 17. | hard — soft | rough | 2—*smooth.* |
| 18. | rug — floor | pictures | 2—*wall;* 0—*ceiling.* |
| 19. | box — wood | bottle | 2—*glass.* |
| 20. | snow — sleds | ice | 2—*skates;* 1—*boats.* |
| 21. | baker — bread | bees | 2—*honey;* 1—*wax.* |
| 22. | people — house | birds | 2—*nest;* 1—*cage;* 1—*tree;* 1—*birdhouse.* |
| 23. | under — over | down | 2—*up.* |
| 24. | triangle — three | square | 2—*four.* |
| 25. | number — figures | word | 2—*letters.* |
| 26. | sugar — bowl | milk | 2—*pitcher;* 1—*pail;* 1—*bottle;* 0—*glass;* 0—*cup.* |
| 27. | foot — leg | hand | 2—*arm.* |
| 28. | hair — goat | wool | 2—*sheep;* 1—*lamb.* |
| 29. | river — Hudson | mountain | 2—*(Any mountain.)* |
| 30. | silver — tarnish | iron | 2—*rust;* 2—*corrode;* 1—*oxidize.* |

| | | | |
|---|---|---|---|
| 31. | fruit — basket | water | 2—*pail*; 2—*bottle*; 2—*pitcher*; 2—*jug*; 2—*jar*; 2—*bucket*; 0—*glass*. |
| 32. | foot — ankle | hand | 2—*wrist*. |
| 33. | park — play | school | 2—*work*; 2—*study*; 1—*learn*. |
| 34. | wall — paper | floor | 2—*carpet*; 2—*rugs*; 2—*paint*; 2—*varnish*; 2—*oil*. |
| 35. | sit — sat | fly | 2—*flew*; 1—*flown*. |
| 36. | grain — wheat | fruit | 2—*(Any kind of fruit.)* |
| 37. | man — legs | carriage | 2—*wheels*. |
| 38. | violet — odor | red | 2—*color*. |
| 39. | coal — black | gold | 2—*yellow*. |
| 40. | fire — warms | ice | 2—*cools*; 1—*chills*; 1—*freezes*; 0—*cold*. |
| 41. | leg — knee | arm | 2—*elbow*. |
| 42. | bright — colors | loud | 2—*sounds*; 2—*tones*; 2—*noises*. |
| 43. | kettle — utensil | chair | 2—*furniture*. |
| 44. | park — gate | house | 2—*door*. |
| 45. | lilac — shrub | fern | 2—*plant*; 0—*herb*. |
| 46. | April — March | Tuesday | 2—*Monday*. |
| 47. | fork — tine | knife | 2—*blade*; 0—*edge*. |
| 48. | larva — moth | caterpillar | 2—*butterfly*. |
| 49. | house — door | field | 2—*gate*; 0—*fence*. |
| 50. | fair — cloudy | sunshine | 2—*rain*. |

## Key to Analogies C

| | | | |
|---|---|---|---|
| 1. | screw — screwdriver | nail | 2—*hammer*. |
| 2. | refrigerator — cold | radiator | 2—*heat*; 2—*warm*; 2—*hot*. |
| 3. | snow — falls | wind | 2—*blows*. |
| 4. | December — cold | July | 2—*hot*; 2—*warm*. |
| 5. | yarn — knit | thread | 2—*sew*. |
| 6. | teeth — chew | ears | 2—*hear*. |
| 7. | roof — tin | window | 2—*glass*. |
| 8. | stove — heat | lamp | 2—*light*. |
| 9. | cellar — down | garret | 2—*up*. |
| 10. | plate — eat | cup | 2—*drink*. |
| 11. | day — week | week | 2—*month*. |
| 12. | banana — long | orange | 2—*round*. |
| 13. | Longfellow — poet | Edison | 2—*inventor*; 2—*scientist*; 0—*machinist*. |
| 14. | flowerbed — flowers | garden | 2—*vegetables*. |
| 15. | pen — write | needle | 2—*sew*. |
| 16. | farmer — grain | banker | 2—*money*. |
| 17. | bed — sleep | chair | 2—*sit*. |
| 18. | dog — runs | worm | 2—*crawls*. |
| 19. | horse — barn | automobile | 2—*garage*; 0—*shed*. |

| | | | |
|---|---|---|---|
| 20. | brush — teeth | comb | 2—*hair.* |
| 21. | shoe — lace | coat | 2—*button.* |
| 22. | birds — fly | rabbits | 2—*jump;* 2—*hop;* 1—*leap;* 1—*run.* |
| 23. | rowboat — oars | canoe | 2—*paddle.* |
| 24. | Thursday — Wednesday | April | 2—*March.* |
| 25. | house — porch | ship | 2—*deck.* |
| 26. | barley — grain | grapes | 2—*fruit.* |
| 27. | ink — pen | paint | 2—*brush.* |
| 28. | sailor — ship | brakeman | 2—*train.* |
| 29. | salad — fruit | omelet | 2—*eggs.* |
| 30. | city — village | mansion | 2—*house;* 2—*hut;* 2—*hovel;* 2—*cottage;* 2—*cabin.* |
| 31. | invention — inventor | book | 2—*author;* 2—*writer;* 1—*novelist.* |
| 32. | thread — spool | ink | 2—*bottle;* 2—*well.* |
| 33. | cow — calf | sheep | 2—*lamb;* 0—*ewe;* 0—*sheep.* |
| 34. | stockings — shoes | necktie | 2—*collar;* 0—*shirt.* |
| 35. | sugar — sweet | quinine | 2—*bitter.* |
| 36. | broker — stock | butcher | 2—*meat;* 1—*cuts.* |
| 37. | yard — length | pound | 2—*weight.* |
| 38. | ball — rolls | wheel | 2—*turns;* 2—*revolves;* 2—*rotates.* |
| 39. | sad — weep | happy | 2—*laugh;* 2—*smile.* |
| 40. | hat — band | shoe | 2—*lace.* |
| 41. | engine — engineer | trolleycar | 2—*motorman;* 0—*trolleyman;* 0—*conductor.* |
| 42. | floor — wood | ceiling | 2—*plaster;* 0—*tin.* |
| 43. | buffalo — herd | wolves | 2—*pack.* |
| 44. | farmer — plows | clerk | 2—*sells.* |
| 45. | fish — rod | hunt | 2—*gun;* 2—*rifle.* |
| 46. | wood — stain | cloth | 2—*dye.* |
| 47. | automobile — motor | wagon | 2—*horse.* |
| 48. | grain — food | coal | 2—*fuel;* 0—*fire.* |
| 49. | loud — yell | soft | 2—*whisper;* 0—*talk;* 0—*cry;* 0—*murmur;* 0—*speak;* 0—*sing;* 0—*sound.* |
| 50. | ton — pound | pound | 2—*ounce.* |

### Key to Analogies D

| | | | |
|---|---|---|---|
| 1. | murderer — kills | thief | 2—*steals;* 2—*robs.* |
| 2. | pencil — write | knife | 2—*cut;* 1—*whittle;* 1—*carve.* |
| 3. | slide — down | climb | 2—*up.* |
| 4. | coffee — hot | water | 2—*cold;* 1—*cool.* |
| 5. | beet — red | butter | 2—*yellow.* |
| 6. | apple — fruit | turnip | 2—*vegetables.* |

| | | | |
|---|---|---|---|
| 7. | bees — honey | cows | 2—*milk.* |
| 8. | chair — wood | bottle | 2—*glass.* |
| 9. | bell — rings | whistle | 2—*blows;* 2—*toots;* 0—*whistles.* |
| 10. | forest — trees | village | 2—*houses;* 2—*buildings;* 2—*people.* |
| 11. | cavalry — ride | infantry | 2—*walk;* 2—*march;* 0—*hike;* 0—*run.* |
| 12. | canal — narrow | river | 2—*wide;* 2—*broad.* |
| 13. | cattle — leather | sheep | 2—*wool.* |
| 14. | store — merchandise | library | 2—*books.* |
| 15. | school — teacher | church | 2—*minister;* 2—*pastor;* 2—*preacher;* 2—*parson;* 2—*priest.* |
| 16. | potatoes — boil | bread | 2—*bakes.* |
| 17. | fish — fins | birds | 2—*wings;* 2—*wing;* 1—*feathers.* |
| 18. | cat — kitten | dog | 2—*puppy.* |
| 19. | second — minute | minute | 2—*hour.* |
| 20. | butter — cream | cheese | 2—*milk;* 2—*whey;* 2—*curd;* 0—*cream.* |
| 21. | London — far | Chicago | 2—*near.* |
| 22. | heart — beats | clock | 2—*ticks;* 0—*spins;* 0—*runs;* 0—*strikes.* |
| 23. | May — April | Wednesday | 2—*Tuesday.* |
| 24. | dog — hair | hen | 2—*feathers.* |
| 25. | under — over | below | 2—*above;* 0—*up;* 0—*high;* 0—*on top.* |
| 26. | here — there | now | 2—*then.* |
| 27. | up — stand | down | 2—*sit.* |
| 28. | pen — ink | needle | 2—*thread.* |
| 29. | street — city | road | 2—*country;* 0—*village;* 0—*town.* |
| 30. | wood — warms | ice | 2—*cools;* 2—*chills.* |
| 31. | college — president | school | 2—*principal;* 2—*principle;* 2—*superintendent.* |
| 32. | mason — stone | carpenter | 2—*wood.* |
| 33. | box — wood | satchel | 2—*leather;* 1—*rattan.* |
| 34. | cold — frost | cloudy | 2—*rain;* 1—*mist;* 1—*damp;* 0—*wet;* 0—*vapor;* 0—*fog;* 0—*dew;* 0—*hail.* |
| 35. | shoe — leather | book | 2—*paper;* 1—*cloth.* |
| 36. | stove — coal | lamp | 2—*oil;* 2—*kerosene.* |
| 37. | spend — earn | lend | 2—*borrow.* |
| 38. | loud — sound | bright | 2—*color;* 2—*light.* |
| 39. | sculptor — chisel | painter | 2—*brush;* 2—*palette and brush.* |
| 40. | car — seats | room | 2—*chairs.* |

| | | | |
|---|---|---|---|
| 41. | knife — blade | fork | 2—*tine*; 2—*prong*. |
| 42. | magazine — wrapper | letter | 2—*envelope*. |
| 43. | wagon — wheels | aeroplane | 2—*wings*. |
| 44. | blanket — wool | pillow | 2—*feathers*; 2—*down*. |
| 45. | river — brook | mountain | 2—*hill*. |
| 46. | thunder — lightning | wind | 2—*rain*; 1—*storm*; 1—*hail*. |
| 47. | can — top | bottle | 2—*cork*; 2—*stopper*; 0—*nose*. 0—*neck*. |
| 48. | train — rails | boat | 2—*water*; 1—*river*; 1—*sea*; 1—*stream*; 1—*lake*. |
| 49. | knife — blade | needle | 2—*point*. |
| 50. | bird — wings | horse | 2—*legs*. |

## Key to Opposites Test A

| | | |
|---|---|---|
| 1. | outside | 2—*inside*<br>1—*interior, within* |
| 2. | near | 2—*far, distant*<br>0—*away* |
| 3. | black | 2—*white*<br>0—*red, light* |
| 4. | sick | 2—*well, healthy*<br>0—*fine, recuperated, convalescent* |
| 5. | friend | 2—*enemy, foe*<br>0—*unfriend* |
| 6. | open | 2—*shut, closed*<br>1—*close* |
| 7. | new | 2—*old*<br>1—*aged, ancient, antiquated, out-of-date*<br>0—*worn, faded, stale* |
| 8. | dark | 2—*light*<br>1—*bright, white*<br>0—*shiny, dawn* |
| 9. | thick | 2—*thin*<br>1—*sparse, slender, slim*<br>0—*few, meagre, small, bright* |
| 10. | awake | 2—*asleep*<br>1—*sleeping*<br>0—*sleep* |
| 11. | right | 2—*wrong, left, incorrect*<br>1—*erroneous*<br>0—*unright, wise, uncertain* |
| 12. | straight | 2—*crooked, curly, bent, curved, zig-zag*<br>1—*uneven, slant, winding, wavering, dishonest* |
| 13. | dull | 2—*sharp, bright*<br>1—*brilliant, shiny, radiant, glossy*<br>0—*wise, cute, bleak, smooth* |

| | | |
|---|---|---|
| 14. | peace | 2—*war, hostility*<br>1—*fighting, unrest, trouble*<br>0—*whole, all, quarrel* |
| 15. | certain | 2—*uncertain, doubtful*<br>1—*questionable*<br>0—*opinion, probable, unlikely* |
| 16. | wild | 2—*tame, tamed, civilized, cultivated*<br>1—*gentle, settled*<br>0—*timid* |
| 17. | stupid | 2—*clever, bright*<br>1—*wise, smart, brilliant*<br>0—*unstupid, wicked, quiet, good* |
| 18. | artificial | 2—*genuine, natural, real*<br>1—*true, sincere*<br>0—*solid* |
| 19. | sorry | 2—*glad*<br>1—*happy*<br>0—*mad, joy, unsorry, cheerful, pleased, cheerfully, satisfied* |
| 20. | public | 2—*private*<br>1—*secret, individual, secluded, enclose, hidden*<br>0—*social, individualistic, reserved, censored* |
| 21. | sleepy | 2—*awake, wakeful, alert, wide-awake*<br>1—*keen, refreshed, rested*<br>0—*tired* |
| 22. | double | 2—*single*<br>1—*one*<br>0—*singular, half, one-half, alone, solitary* |
| 23. | idle | 2—*busy, employed*<br>1—*working, industrious, active*<br>0—*work, ambitious* |
| 24. | patient | 2—*impatient*<br>1—*restless, irritable*<br>0—*unpatient, doctor, sick, nervous, well, quick, hasty, petulant, stubborn, calm, impetuous, fretful* |
| 25. | similar | 2—*different, unlike, dissimilar*<br>1—*opposite*<br>0—*unsimilar, familiar* |
| 26. | poor | 2—*rich, wealthy*<br>1—*fat, fleshy, excellent, stout*<br>0—*abundant, good* |
| 27. | float | 2—*sink*<br>1—*swim*<br>0—*sail, drown, struggle, propel* |
| 28. | cheap | 2—*expensive, costly, dear*<br>1—*valuable*<br>0—*high, exorbitant* |

29. fail
2—*succeed*
1—*win, pass, prosper*
0—*success, promote, promoted, increase, do*

30. innocent
2—*guilty*
1—*vicious, culprit, guileful*
0—*wise, non-participant*

31. sharp
2—*blunt, dull*
1—*stupid*
0—*unkeen*

32. stingy
2—*liberal, generous, lavish*
1—*prodigal, unselfish, free, good-hearted*
0—*kind, unstingy, giving, wasteful*

33. stormy
2—*clear, placid, settled, fair, calm*
1—*sunshiny, still, quiet, pleasant, sunny*
0—*windy, beautiful, sunshine*

34. rude
2—*polite, gentle, courteous, cultured, refined*
1—*polished, kind*
0—*unrude, good, nice, fine*

35. past
2—*present, future*
1—*now, coming, here*
0—*stayed, remained*

36. ignorant
2—*wise, intelligent, learned, educated*
1—*bright, brilliant, intellectual*
0—*smart, keen*

37. hinder
2—*help, assist, aid*
1—*encourage, support*
0—*initiate, prop*

38. blurred
2—*plain, clear, distinct*
1—*cleared, clarified*
0—*unblurred, bright, brighten, clarify, steady*

39. respect
2—*disrespect, despise, contempt, disdain*
1—*disregard, dishonor, scorn*
0—*unrespect, venerate, belittle*

40. native
2—*foreign, foreigner, alien*
1—*acquired, newcomer*
0—*wild, emigrant*

41. vanish
2—*appear*
1—*reappear*
0—*come, here, present, stay, stayed, remain, apparent, evident, continue, retain*

42. broken
2—*whole, unbroken, mended*
1—*straight, repaired, intact*
0—*together, unite, fixed*

43. lazy
2—*industrious, energetic, hard-working*
1—*ambitious, busy, active*
0—*ambition, unlazy, quick, bright, willful, speedy, sleepy, willing, wise, helpful, lively, spry, smart, eager, alert*

| | | |
|---|---|---|
| 44. | modern | 2—*ancient, antique, antiquated, old-fashioned, old*<br>1—*past*<br>0—*unmodern* |
| 45. | feed | 2—*starve*<br>1—*deprive, disgorge*<br>0—*hungry, hunger, famished, weaken* |
| 46. | raw | 2—*cooked*<br>1—*well-done*<br>0—*ripe, sweet, smooth, tender, soft, cultured, boiled* |
| 47. | slope | 2—*level, flat*<br>1—*prairie*<br>0—*straight, even, evenly, hill, elevation, abrupt, steep* |
| 48. | fatigued | 2—*rested*<br>1—*fresh, alert, vigorous*<br>0—*comfortable, rest, keen, energetic, ambitious* |
| 49. | unite | 2—*separate, divide, disband*<br>1—*disunite, sever, scatter, disconnect*<br>0—*apart, together, ununited, open, cut* |
| 50. | permanent | 2—*temporary, shifting, transient, transitory*<br>1—*movable, unstable, vacillating*<br>0—*uncertain, short* |

### Key to Opposites Test B

| | | |
|---|---|---|
| 1. | early | 2—*late*<br>1—*tardy* |
| 2. | slow | 2—*fast, quick, rapid*<br>1—*lively, hurried* |
| 3. | dirty | 2—*clean, immaculate, unsoiled*<br>1—*fresh*<br>0—*washed* |
| 4. | crooked | 2—*straight, vertical, horizontal*<br>0—*perpendicular, bent, curled* |
| 5. | empty | 2—*full*<br>1—*filled* |
| 6. | heavy | 2—*light*<br>0—*thin, bright, active, keen, small* |
| 7. | dry | 2—*wet*<br>1—*moist, rainy*<br>0—*showery, misty* |
| 8. | quiet | 2—*noisy*<br>1—*loud, talkative, boisterous*<br>0—*noise* |
| 9. | many | 2—*few*<br>0—*small, little, none, one, couple, several* |
| 10. | enemy | 2—*friend*<br>1—*ally*<br>0—*army, angel, Hun* |

11. peace
2—*war, hostility*
1—*fighting, unrest, trouble*
0—*whole, all, quarrel*

12. happy
2—*sorry, sad, unhappy*
1—*angry, sorrow, mad*
0—*sorrowful, discontented*

13. tall
2—*short*
1—*stubby*
0—*small, little, runt*

14. sunny
2—*cloudy, shady*
1—*gloomy, rainy, shaded*
0—*rain, dark, dull*

15. spend
2—*save, earn, hoard*
1—*keep, receive, conserve*
0—*saved, safe, bank*

16. few
2—*many*
0—*couple, lot, one, several, much, quantity, no*

17. rough
2—*smooth, even*
1—*gentle, kind, polished*
0—*soft*

18. distant
2—*near, nearby*
1—*close*
0—*nearness, present, here*

19. stout
2—*slender, thin, slim, lean*
1—*weak, skinny, slimsy*
0—*unstout, tall*

20. necessary
2—*unnecessary, useless, unessential, needless*
0—*superficial*

21. moist
2—*dry*
1—*arid*
0—*wet, powdery*

22. drowsy
2—*awake, wide-awake*
1—*alert, animated, bright, wakeful, energetic, vivacious*
0—*lively, vigorous, boisterous, keen, brilliant*

23. careless
2—*careful, cautious, watchful*
1—*neat, trim, tidy, well-groomed*
0—*care, kind, immaculate, suspicious*

24. end
2—*begin, beginning*
1—*continue, first, start, commencement*
0—*middle, side, front, fore, means*

25. cloudy
2—*clear*
1—*fair, bright, sunny*
0—*uncloudy, shiny, sunshine, light*

26. latest
2—*earliest*
1—*oldest*
0—*youngest, farthest*

| | | |
|---|---|---|
| 27. | single | 2—*double*<br>1—*together, married, span, couple, pair*<br>0—*plural* |
| 28. | push | 2—*pull, draw*<br>1—*haul* |
| 29. | together | 2—*apart, separately*<br>1—*alone, separate, scattered*<br>0—*single, away, scatter* |
| 30. | wise | 2—*foolish, unwise*<br>1—*stupid, ignorant, simple*<br>0—*dumb, slow, dull, unwisely* |
| 31. | numerous | 2—*few, scarce*<br>1—*scanty, sparse*<br>0—*unnumerous, scarcity* |
| 32. | strength | 2—*weakness*<br>1—*inability, incapacity*<br>0—*weak* |
| 33. | joy | 2—*sorrow, sadness*<br>1—*unhappiness, misery*<br>0—*sad, happy, sorry, angry, unhappy, sober* |
| 34. | gentle | 2—*rough, harsh, brutal*<br>1—*cruel, mean, hard, rude, ferocious*<br>0—*ungentle, savage, uncivilized, wild, inconsiderate* |
| 35. | sturdy | 2—*weak*<br>1—*anaemic, sickly*<br>0—*unsturdy, limber, pale, colorless, lifeless, pallid, vacillating, wan* |
| 36. | safe | 2—*unsafe, dangerous*<br>0—*danger, doubtful, uncertain* |
| 37. | kneel | 2—*stand*<br>1—*arise*<br>0—*lay, erect* |
| 38. | most | 2—*least, fewest*<br>0—*less, little, few, none, smallest* |
| 39. | help | 2—*hinder, prevent, interfere*<br>1—*resist, oppose, injure, hindrance*<br>0—*hurt* |
| 40. | massive | 2—*small*<br>1—*little, insignificant, tiny, slender, miniature, unimposing*<br>0—*few* |
| 41. | memorize | 2—*forget*<br>1—*unlearn*<br>0—*learn, lose, shirk, recall, remember* |
| 42. | prolong | 2—*shorten, diminish, decrease*<br>1—*lessen, stop* |

43. receive
2—*give, bestow, confer, grant*
1—*send*
0—*accept, loan*

44. false
2—*genuine, real, true*
0—*unfalse, truth, loud, sound*

45. friendly
2—*unfriendly, hostile*
1—*inimical, hateful*
0—*Hun, cross, enemy, cruel, selfish, foe, cold, angry, hate, fiendish*

46. prompt
2—*late*
1—*tardy, slow*
0—*quick, unprompt, neglectful*

47. reproach
2—*praise, commend*
1—*compliment, approve, endorse*
0—*accuse*

48. liberty
2—*slavery, confinement, bondage, servitude*
1—*autocracy, tyranny, imprisoned, imprisonment*
0—*prison, confined, mastered, unfree, war*

49. impoverish
2—*enrich*
1—*increase, nourish, feed, sustain, upbuild, provide*
0—*greedy, rich, starve, exist*

50. enter
2—*leave, depart, withdraw*
1—*exit, go*
0—*retract*

### Key to Opposites Test C

1. slow
2—*fast, quick, rapid*
1—*lively, hurried*

2. inside
2—*outside*
1—*without, external, exterior*

3. front
2—*back, rear*

4. clean
2—*dirty, unclean, soiled*
0—*dirt*

5. above
2—*below, beneath*
1—*underneath*
0—*lower*

6. little
2—*big*
1—*large, massive, ponderous*

7. wet
2—*dry*
0—*dried*

8. smooth
2—*rough*
1—*uneven, jagged, irregular*
0—*hard, haltingly, creaky*

9. well
2—*sick, ill, unwell*
1—*badly*
0—*wrong, better, bad, wounded*

| | | |
|---|---|---|
| 10. | dislike | 2—*like*<br>1—*love*<br>0—*approve, want* |
| 11. | spend | 2—*save, keep, hoard*<br>1—*bank, get, acquire*<br>0—*saved, unspend, receive* |
| 12. | after | 2—*before, previous, preceding*<br>1—*ahead*<br>0—*following* |
| 13. | soft | 2—*hard*<br>1—*loud*<br>0—*smooth, rough* |
| 14. | dead | 2—*alive*<br>1—*live*<br>0—*life, quick* |
| 15. | remember | 2—*forget*<br>0—*recall, learn, grasp* |
| 16. | weak | 2—*strong*<br>1—*robust*<br>0—*healthy, stout, good, well* |
| 17. | upper | 2—*lower*<br>0—*down, beneath, downward, below, under* |
| 18. | always | 2—*never*<br>1—*seldom, sometimes*<br>0—*occasionally* |
| 19. | sorry | 2—*glad*<br>1—*happy*<br>0—*mad, joy, unsorry, cheerful, pleased, cheerfully, satisfied* |
| 20. | necessary | 2—*unnecessary, useless, unessential, needless*<br>0—*superficial* |
| 21. | lengthen | 2—*shorten*<br>1—*contract, decrease*<br>0—*short, fold, discontinue* |
| 22. | increase | 2—*decrease, lessen, diminish, wane*<br>1—*deteriorate*<br>0—*smaller* |
| 23. | true | 2—*false, untrue*<br>1—*fraudulent*<br>0—*lie, liar, guilty, dishonest* |
| 24. | silent | 2—*talkative, noisy*<br>0—*noise, disorderly, loud, loudly, talking* |
| 25. | retail | 2—*wholesale* |
| 26. | foolish | 2—*sensible, wise*<br>1—*bright, clever, reasonable, rational, sane*<br>0—*smart, nice, unfoolish, brilliant* |

27. even
2—*uneven, odd*
1—*irregular*
0—*rough, crooked, rugged, quick, hasty*

28. earn
2—*spend*
0—*loan, save, borrow, steal, stolen, spent, charge, sponge*

29. regular
2—*irregular*
0—*unregular, uneven, tardy, insurgent*

30. continue
2—*stop, quit, cease, discontinue*
1—*end, finish, conclude, pause*
0—*uncontinued, recontinue*

31. left
2—*right, remaincd*
1—*stayed*
0—*took, borrow, has, gone, came*

32. heathen
2—*Christian*
1—*civilized, believer*
0—*native*

33. deceitful
2—*honest, truthful, trustworthy, frank, above-board*
1—*true, reliable, open*
0—*rightful*

34. punctual
2—*late, tardy*
1—*behindhand*
0—*slack, remiss, thoughtless*

35. leave
2—*stay, take, arrive*
1—*come*
0—*took, go, bring, fetch*

36. ugly
2—*pretty, beautiful*
1—*handsome, good-looking, lovely*
0—*good, nice, pleasant, happy, glad, kind, gentle, sweet friendly, cheerful*

37. superior
2—*inferior, subordinate*
1—*common, lower, beneath*
0—*unsuperior, usual, under, below*

38. often
2—*seldom, rarely*
1—*never, sometimes*
0—*unfrequent, unfrequently*

39. plentiful
2—*scarce, scanty*
1—*sparse, rare, scarcity, few*
0—*shortage, famine, frugal, need, needy, lack*

40. busy
2—*idle, inactive, indolent, loafing*
1—*lazy, unoccupied*
0—*slow, quiet, loaf*

41. suitable
2—*unsuitable*
1—*unsuited, faulty, improper, clashing, unbecoming*
0—*inharmonious, jarring, misfit, misfitting*

42. survive
*die, perish*
1—*sink, starve*
0—*unsurvive, yield, surrender*

| | | |
|---|---|---|
| 43. | reveal | 2—*hide, conceal*<br>1—*cover, secret, secreted*<br>0—*disclose* |
| 44. | part | 2—*all, whole, join, unite*<br>0—*close* |
| 45. | timid | 2—*bold, aggressive*<br>1—*forward, brave*<br>0—*strong, vigorous, boisterous, rash, frank, open, foolhardy, impetuous* |
| 46. | civil | 2—*uncivil*<br>1—*military*<br>0—*wild, criminal, foreign, private, professional* |
| 47. | faulty | 2—*faultless, perfect, correct*<br>1—*right, blameless*<br>0—*whole, intact* |
| 48. | economical | 2—*uneconomical, wasteful, extravagant, prodigal*<br>1—*lavish, spendthrift*<br>0—*wasting, waste, unsaving, extravagance* |
| | | 1—*true, actual, practical* |
| 49. | imaginary | 2—*real*<br>0—*unimaginary, plain, clear-minded* |
| 50. | follow | 2—*lead*<br>1—*stay, remain, precede*<br>0—*leave, stop, retreat, initiate* |

KEY TO OPPOSITES TEST D

| | | |
|---|---|---|
| 1. | late | 2—*early*<br>1—*timely, beforehand, punctual*<br>0—*punctually* |
| 2. | fast | 2—*slow*<br>0—*run* |
| 3. | wrong | 2—*right, correct*<br>1—*perfect* |
| 4. | narrow | 2—*wide, broad*<br>0—*straight* |
| 5. | rich | 2—*poor*<br>0—*thin* |
| 6. | alive | 2—*dead*<br>0—*asleep, died, dormant, petrified, conservative* |
| 7. | thin | 2—*fat, thick*<br>1—*fleshy, plump, stout*<br>0—*dense, heavy* |
| 8. | sad | 2—*happy, glad*<br>1—*cheerful, joyful, merry, joyous, jubilant*<br>0—*joy* |
| 9. | many | 2—*few*<br>0—*small, little, none, one, couple, several* |

10. beautiful
2—*homely, ugly*
1—*plain, inharmonious*
0—*horrid, drab, bad, loathsome*

11. absent
2—*present*
1—*here*
0—*presence, late*

12. raise
2—*lower*
1—*sink, depress, decrease*
0—*low, deep, lay, deepen, set, retrogression*

13. evening
2—*morning*
0—*day, noon*

14. sharp
2—*dull, blunt*
0—*unsharp, round, long, smooth*

15. loud
2—*soft*
1—*still, quiet, low*
0—*noise, softly, silent*

16. rough
2—*smooth, even*
1—*gentle, kind, polished*
0—*soft*

17. big
2—*little*
1—*small*
0—*short*

18. construct
2—*destroy, demolish*
1—*break*
0—*tear, tumble, disarrange*

19. tighten
2—*loosen, relax*
1—*loose, release, yield, unscrew*
0—*loosely, lose, desist, decrease*

20. simple
2—*difficult, complex, complicated, elaborate, compound, fancy*
1—*hard, wise, profound, brilliant*
0—*great, aristocratic, keen, vain, frivolous*

21. stale
2—*fresh*
1—*new*
0—*renewed, refreshed, vigorous, lively, enlivened*

22. full
2—*empty*
1—*vacant*
0—*unfull, part*

23. noisy
2—*quiet*
1—*still*
0—*unnoisy, softly, low, stillness, soft*

24. honest
2—*dishonest*
1—*untruthful, false, fraudulent*
0—*crooked, liar, robber, thief, cheat, unhonest, truth, guilty, lie, sneaky, cheater*

| | |
|---|---|
| 25. cruel | 2—*kind, tender*<br>1—*loving, gentle, sympathetic*<br>0—*uncruel, good, nice, kindness, mild, fondling* |
| 26. generous | 2—*stingy, selfish, miserly, parsimonious*<br>1—*greedy, niggardly*<br>0—*mean, hard, ungenerous, ugly, niggard, meager, thrifty, uncharitable* |
| 27. famine | 2—*plenty, abundance, feast*<br>1—*harvest*<br>0—*bountiful, food, alleviation* |
| 28. take | 2—*leave, give*<br>1—*release*<br>0—*permit, allow, send* |
| 29. never | 2—*always*<br>1—*sometime, ever, forever*<br>0—*new, again, frequent, seldom* |
| 30. silence | 2—*noise, commotion*<br>1—*loudness, speech, sound, talkativeness*<br>0—*noisy, laughter, crying, taciturnity* |
| 31. hostile | 2—*friendly*<br>1—*kind, helpful*<br>0—*unhostile, liking* |
| 32. inferior | 2—*superior*<br>1—*better, higher*<br>0—*above, upper* |
| 33. remote | 2—*near, close, neighboring, nearby*<br>1—*recent, adjoining, present*<br>0—*unremote, proximity, here, probable, likely* |
| 34. doubtful | 2—*certain, sure, positive, unquestionable*<br>1—*true*<br>0—*believe, undoubtful, certainty, candid, trustworthy, undoubted* |
| 35. level | 2—*rough, hilly, uneven, undulating, irregular*<br>1—*slope, slanting, slant, rugged, rocky*<br>0—*unsmooth, unlevel, crooked* |
| 36. succeed | 2—*fail*<br>1—*unsuccessful, defeat, precede*<br>0—*unsucceed, yield* |
| 37. humble | 2—*proud, haugty, arrogant, exalted*<br>0—*unhumble, rich, dignity, dignified, bold, valiant, aggressive, aristocratic* |
| 38. break | 2—*mend, repair*<br>1—*patch, heal, unite, connect, combine, fix*<br>0—*bend, whole* |
| 39. pleasant | 2—*unpleasant, disagreeable*<br>0—*rude, sad, miserable, horrid, mean, sorry, sullen, mad, ugly, grouchy, unkind, spiteful* |

40. clumsy
2—*agile, graceful, nimble, skillful*
1—*dainty, quick, active, light, supple, handy*
0—*unclumsy, fast, tidy*

41. diligent
2—*lazy, idle*
1—*slack*
0—*careless, heedless, slow*

42. miser
2—*spend-thrift, prodigal, spender, philanthropist*
1—*giver*
0—*banker, generous, kind, unstingy, lavish, spend, giving, friend*

43. genuine
2—*false, artificial, fake, sham, spurious, insincere, imitation*
1—*dishonest, unreal*
0—*ungenuine, crooked*

44. general
2—*private, specific, special, individual, particular*
1—*local*
0—*commander, captain, lieutenant, soldier, individualistic*

45. obscure
2—*plain, clear, evident*
1—*prominent, noticeable, well-known, famous, obvious, notorious, conspicuous, apparent*
0—*unambiguous, important*

46. cautious
2—*incautious, careless, reckless*
1—*bold, rash, indiscreet*
0—*uncareful, noisy, uncautious*

47. haughty
2—*humble, unassuming*
1—*modest, meek*
0—*polite, lovable, unhaughty, mild, plain, common, sympathetic*

48. exciting
2—*unexciting, dull, quieting, monotonous*
1—*calm, calming, reposeful, tame*
0—*calmly, slow, stupid*

49. frequently
2—*seldom*
1—*never*
0—*few, scarce, unfrequent, unfrequently*

50. lavish
2—*stingy, miserly*
1—*niggardly, thrifty, frugal, economical, stint, stinted*
0—*unlavish, save, sparingly, few*

# A Study of Twenty High School Seniors of Superior Intelligence

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*Purpose and Method of This Study.* The aim of this investigation was to study a group of high school seniors of superior intelligence. Various questions suggested themselves, viz.: (1) What kind of homes do these young persons come from? (2) Are their parents or other relatives superior in any respect? (3) Are the young people themselves superior as to health, or were they precocious in physical development? (4) What evidences are there of mental precocity or unusual ability? (5) In what other respects do these superior boys and girls differ mentally from their fellows? It was possible to deal with the first four questions with some degree of thoroughness, but the last called for far too elaborate treatment. However, the matter of interests, especially vocational interests, received some attention.

The Otis group tests (Oakland edition), which are similar to the tests of general intelligence used in our army during the Great War, were given to the five hundred and forty-three high school seniors of Oakland, California, in March, 1919.[1] The twenty pupils who scored highest, *i. e.*, less than 4 per cent, were selected for study. For comparison, another group of twenty, whose test scores lay at, or next to, the median score, was chosen. The next step was to make copies of all school records concerning each of the forty. Besides this, as many teachers as possible were asked to give their estimates of each pupil's intelligence and to add any other information they could. Then visits were made to the homes of the twenty superior young persons, where the writer obtained information as to the education, occupation, and achievements of parents and grandparents, the young person's physical development and health, early education, mental development, interests, duties, character, special abilities, and finally, home surroundings, brothers and sisters, special

[1]The writer is indebted to Dr. Virgil E. Dickson, Director of the Oakland Department of Research, for his assistance and advice. Thanks are also due to Professor Warner Brown of the University of California for direction and criticism of this study.

influences, etc. In every case the parents answered most willingly. It should be added that they were almost always reluctant to stress their own children's superiority. The tendency seemed to be to underestimate their ability rather than the reverse. Lastly, a questionnaire dealing primarily with interests was filled out by the forty young persons. This they did in small groups, generally three or four at a time, in the presence of the writer. In some cases she had friendly talks with the pupils in their own homes, but usually the times devoted to the questionnaire furnished the only opportunity for talking with them. They seemed friendly, interested, and anxious to answer the questions carefully.

It must be remembered that one group test does not provide a completely satisfactory way of rating intelligence. Possibly a good many pupils did not do themselves justice. Moreover, we should not claim too much for the tests themselves. Doubtless they fail to give evidence of numerous phases of intellectual superiority. However, the superior pupils selected certainly rank high in the mental abilities that the tests measure.

*The Nature of the Two Groups Selected.* It is apparent from Table I that the mental-test ratings of the superior group range from 165 (out of a possible 172 points) to 149. The median for all the seniors was 118. Eight had precisely this score. To complete what is here called "the median group," twelve pupils whose ratings lay at 117 or 119 were chosen in the chance order in which their names were recorded, rejecting, however, two foreign-born pupils who did not speak English fluently.

Table I shows that there are fourteen boys and only six girls in the superior group. Furthermore, the girls are noticeably below the boys in their standing.[2] There is only one girl among the seven students at or above 160, and the rest of the girls fall below 156. Just what this sex difference indicates is not clear. Does it point to the inferiority of the female sex in "general intelligence"? Does it support the theory of greater male variability? Or is it that the Otis tests are better adapted to masculine intellect, training, or temperament. Or are there other factors at work,

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[2]Cf. L. M. TERMAN, *The Intelligence of School Children*, N. Y., 1919, pp. 171-172, for somewhat similar findings. The writer has had many suggestions as to the general method of this study from the work of Terman and Margaret Hopwood Hubbard.

TABLE I. SUPERIOR GROUP

| Person's Number | Boy or Girl | Mental-Test Rating | Average of High School Marks | Teachers' Estimate of Intelligence | Course | Age at Graduation from High School |
|---|---|---|---|---|---|---|
| 1 | B | 165 | 2+ | 1 | College Preparatory | 17 yrs. 10 mos. |
| 2 | B | 162 | 1— | 1 | " " | 16 " 10 " |
| 3 | B | 161 | 1— | 1 | " " | 16 " 2 " |
| 4 | B | 160 | 2 | 1 | " " | 19 " 10 " |
| 5 | G | 160 | 2+ | 1 | " " | 17 " 9 " |
| 6 | B | 160 | 1— | 1 | " " | 17 " 7 " |
| 7 | B | 160 | 2+ | 1 | " " | 17 " 2 " |
| 8 | B | 158 | 3+ | 3 | " " | 18 " 1 " |
| 9 | B | 157 | 2+ | 2 | " " | 17 " 7 " |
| 10 | G | 156 | 2+ | 1 | " " | 17 " 4 " |
| 11 | B | 155 | 2+ | 2 | General | 16 " 0 " |
| 12 | B | 155 | 2— | 1 | College Preparatory | 16 " 11 " |
| 13 | G | 154 | 1— | 1 | " " | 15 " 11 " |
| 14 | G | 153 | 2+ | 2 | General | 16 " 5 " |
| 15 | B | 152 | 2+ | 1 | College Preparatory | 17 " 9 " |
| 16 | B | 151 | 3 | 3 | General | 19 " 2 " |
| 17 | B | 151 | 3 | 3 | College Preparatory | 17 " 11 " |
| 18 | B | 151 | 2 | 2 | " " | 17 " 5 " |
| 19 | G | 150 | 1— | 1 | " " | 16 " 6 " |
| 20 | G | 149 | 3— | 2 | " " | 16 " 5 " |

TABLE II. MEDIAN GROUP

| Person's Number | Boy or Girl* | Average of High School Marks* | Course | Age at Graduation from High School |
|---|---|---|---|---|
| 21 | B | 2+ | College Preparatory | 17 yrs. 8 mos. |
| 22 | B | 2+ | " " | 19 " 2 " |
| 23 | B | 2 | " " | 17 " 10 " |
| 24 | B | 2 | " " | 17 " 10 " |
| 25 | B | 3+ | " " | 19 " 4 " |
| 26 | B | 3+ | General | 20 " 0 " |
| 27 | B | 3+ | Commercial | 18 " 4 " |
| 28 | B | 3 | College Preparatory | 18 " 5 " |
| 29 | B | 3 | General | 18 " 3 " |
| 30 | B | 3 | " | 18 " 2 " |
| 31 | B | 3— | " | 20 " 1 " |
| 32 | B | 3— | College Preparatory | 19 " 3 " |
| 33 | G | 1 | College Preparatory | 17 " 2 " |
| 34 | G | 2+ | " " | 17 " 2 " |
| 35 | G | 2+ | General | 17 " 4 " |
| 36 | G | 2 | " | 18 " 0 " |
| 37 | G | 2 | Commercial | 18 " 4 " |
| 38 | G | 2 | College Preparatory | 16 " 8 " |
| 39 | G | 2— | " " | 17 " 8 " |
| 40 | G | 3+ | General | 18 " 2 " |

*Since the mental-test ratings are practically the same for all (117-119), boys and girls have been grouped separately, beginning with those who have the highest school marks.

That the boys excel the girls in the mental tests was also apparent for the senior class as a whole, the median for the girls being 114, for the boys 122. It has been suggested to the writer that the senior boys as a whole might have been superior mentally to the girls, for both inclination and the necessity of going to work would tend to eliminate boys of mediocre intelligence. There were only two-thirds as many senior boys as senior girls. The explanation suggested might well account in part for the boys' superiority. But the writer believes that the chief reason lies in the fact that girls are undoubtedly at a disadvantage in the tests. They suffer from nervousness to a far greater degree than do boys. Their desire to excel becomes "fluster" rather than fruitful effort.

*Scholarship and Teachers' Estimates.* Comparisons were made of the high school marks with the mental-test ratings and also with the teachers' estimates of intelligence. The school records were not entirely uniform, generally because of the pupil's transfer from another city, but it was possible to accord to each young person an average grade, which, it is believed, is trustworthy. The grades 1 (excellent), 2 (thoroughly satisfactory), 3 (passed), 4 (failed conditionally), and 5 (complete failure) are used in the Oakland schools. For the sake of finer discriminations plus and minus signs are added in this study.

As many teachers as possible were asked to estimate each superior pupil's intelligence. It was made clear that intelligence, not simply achievement in studies, was to be judged. 1 is taken to mean "very superior"; 2, "superior"; 3, "average"; 4, "inferior"; and 5, "very inferior." Such estimates for the median group were not completed.

It will be seen from Tables I and II that fifteen, or 75 per cent, of the superior group have scholarship records at or above 2, while only 10, or 50 per cent, of the median group are similarly graded. Furthermore, seventeen of the superior pupils took the college preparatory course, which is considered more difficult than other courses; but of the others only eleven took this harder course. It would seem, then, that the superior group tend to do better in school than the median group, though this by no means always follows. The boys of the median group generally range around 3 and never get as high as 1—; but the median girls usually do 2 or 2+ work, one of them even making the highest record (all 1's) of all forty. The

girls of the superior group also generally surpass the boys of that group in school work. As regards estimates of intelligence different teachers did not always agree, but the writer has tried to give representative figures. These (see Table I) are in considerably closer agreement with the Otis-test ratings than are the school marks.

*Home Conditions.* The home conditions of the superior group were unusually satisfactory. There were no extremes of wealth or poverty, but good, comfortable homes, where the parents were sensible and kindly. The relationship between parent and child, what in the Whittier Scale[3] is called "parental supervision," was found to be particularly good. Four of the twenty were broken homes, but excellently controlled by intelligent mothers. Two of these were widows. The two others had left their husbands when the sons in question were six and eight years of age respectively.

The young person's place for home study was always noted. In every case but one (number 16, not a good student and rated low by his teachers) this was found adequate. Number 7, a remarkably bright boy, did practically no home studying.

*Relatives.* All the pupils of both groups were born in the United States. It must be remembered, however, that two foreign-born pupils were rejected from the median group because of their ignorance of English. In the superior group, ten, or 50 per cent, were born in California; in the median group, fifteen, or 75 per cent.

The nativity of parents was as follows:

| | | Fathers | Mothers | Both Parents |
|---|---|---|---|---|
| Superior | Native-born | 18 | 19 | 18 |
| | Foreign-born | 2 | 1 | 1 |
| Median | Native-born | 14 | 17 | 14 |
| | Foreign-born | 6 | 3 | 3 |

The superior young people, then, were distinctly "American" as to parentage, and somewhat more so than the students whose test rat-

[3] WILLIAMS, J. HAROLD. *The Whittier Scale for Grading Home Conditions.* Journal of Delinquency, Vol. I, 1916, pp. 273-286.

ings fell at the median. Information as to grandparents is slightly incomplete, because in the case of the median group it was obtained solely from the questionnaire, unverified by the parents. Roughly speaking, for the superior group about 60 per cent of the grandparents were native-born, and for the median group about 45 per cent. For both groups, but more particularly the superior, there was a strong preponderance of Anglo-Saxon stock.

An attempt was made to classify the occupations of parents and grandparents according to Taussig's scale, which has five gradations ranging from the well-to-do, or professional, class to that of day-laborers. Judging social status on this basis, the superior group seemed to rank somewhat higher.

The numbers in the following table show how many parents of the superior pupils completed, or nearly completed, the school course indicated:

| Type of Education | Fathers | Mothers | Total | Both Parents |
|---|---|---|---|---|
| Post Graduate | 1 | 0 | 1 | 0 |
| College | 5 | 2 | 7 | 2 |
| Normal School | 0 | 2 | 2 | 0 |
| High School | 8 | 5 | 13 | 4 |
| "Self-Educated" [1] | 4 | 0 | 4 | 0 |
| Grammar School | 7 | 6 | 13 | 6 |

[1] "Self-educated" means with grammar school education supplemented by later study.

Twenty-three, or over one-half, of the parents of the superior boys and girls had a high school or college education. No figures can be given for the median group.

Four of the superior pupils were the only children in their families. In only three of the sixteen remaining families did the mother consider the child in question mentally superior to her other children. In two instances the writer had access to independent data, and these supported the mother's verdict—in the one case, that the child was superior, and in the other, equal in intelligence to the brothers and sisters.

*Health and Physical Development.* According to their parents, twelve of the superior group were strong in infancy, three had only fair health, and five were sickly babies. In only a few cases had the parents kept records of the child's development, so their statements

on many points may well be inaccurate. There is little evidence of precocity in getting the first teeth. However, the young people seem, on the whole, to have been precocious in walking and talking. In respect to walking, Mead's statistical study[4] compares as follows:

| | Range | Median | Average |
|---|---|---|---|
| Mead: 50 normal children* | 11-30 mos. | 13.54 mos. | 14 mos. |
| This study: 20 superior children | 9-19 mos. | 12 mos. | 12 2 mos. |

*Since Mead's normal group comprises children of graduate students and a few professors, it is probably rather above average in intelligence.

Since the term "to walk" has been defined more strictly in this investigation than in Mead's, the above figures represent a conservative estimate. An average of the estimated times when the superior children could first use words in short sentences was found to be about nineteen months. Two years is given by most authorities as the usual average.[5]

The list of illnesses, injuries, etc., of the superior boys and girls indicates that they have had their share. However, twelve, or 60 per cent, were judged by their mothers "very superior" to the average in general health, and only two, or 10 per cent, below average (though not seriously so). One of the latter (number 2) had twice undergone operations (appendicitis and stricture) and was subject to colds besides," and the other (number 18) was a somewhat delicate boy who suffered from various minor ailments. Except that seven of the group wore glasses, none had any physical defects or deformities. None had ever had any neurotic symptoms, though six were "high-strung," or of a "nervous temperament."[6]

If we accept fourteen to sixteen as the usual age of puberty for boys, the group shows some precocity. We find a range from 12 to 17, with an average of 13.7, and a median and mode at 14. It is useless to consider only six girls, though a tendency to early physiological maturity also shows with them.

[4]Mead, C. D. *The Relations of General Intelligence to Certain Mental and Physical Traits.* Teachers' College, Columbia, Contributions to Education, No. 76, 1916.

[5]Holt, Emmett. *Care and Feeding of Children.* N. Y., 1915, p. 35.

[6]Cf. L. M. Terman, *The Intelligence of School Children,* Chapter X, for comparable data in this and the next section. Though Terman's subjects were selected from a greater number and were consequently of a higher mental level, it should be noted that his findings at parallel points are closely similar.

*Education and Mental Development.* In all, four, or one-fifth, of the superior pupils went to kindergarten. Only six, or 30 per cent, ever had any formal home teaching. This varied from merely being taught the alphabet (number 12) to regular instruction in spelling, reading, and number work (numbers 13, 18, 19). Table III shows that thirteen of the twenty had learned to read before they went to school. With twelve of them reading was almost wholly a self-initiated and self-conducted process, they "just picked up reading," or "insisted upon being told what the letters and words meant," etc.

After beginning school thirteen children were regular in attending. Table III briefly indicates the attendance record of the remain-

TABLE III. SUPERIOR GROUP

| Person's Number | Age of Learning to Read. (Age at last Birthday) | Age at Entering School. (Age at nearest Birthday) | Grade Entered First | Regular in School Attendance? | Number of Whole-Year Grades Skipped (Including High School Grades) After Entering School |
|---|---|---|---|---|---|
| 1 | 6 Years | 7 Years | Grade I | Yes | 1 |
| 2 | 5 " | 5 " | " " | Fairly (ill-health) | 2 |
| 3 | 3 " | 6 " | " " | Yes | 2 |
| 4 | 5 " | 6 " | " II* | Yes, but out 2 years (at work from choice) | 0 |
| 5 | At School | 6 " | " I | Yes | 0 |
| 6 | 5 Years | 6 " | " " | Yes | 0 |
| 7 | 5 " | 6 " | " " | Yes, but out 2 yrs. (at work from choice) | 3 |
| 8 | 6 " | 7 " | " " | Yes | 1½ |
| 9 | 4 " | 6 " | " " | Yes (after 9th year) | 1 |
| 10 | At School | 6 " | " " | Yes | 1 |
| 11 | " " | 6 " | " " | Yes | 2 |
| 12 | " " | 6 " | " " | Yes | 1 |
| 13 | 4 Years | 8 " | " V | Yes | 0 |
| 14 | At School | 6 " | " I | Yes | 1½ |
| 15 | " " | 7 " | " " | Yes, but out nearly yr. (illness) | 1 |
| 16 | " " | 7 " | " " | Yes | 0 |
| 17 | 5 Years | 7 " | " " | Yes, but out 1 yr. (serious accident) | 2 |
| 18 | 5 " | 8 " | " III | No (ill-health) | ½ |
| 19 | 5 " | 7½ " | " III† | Yes | ½ |
| 20 | 4 " | 6 " | " I | Yes | 2 |

*This six-year-old went into the second grade at once, though his only previous means of learning had been by listening to his older sister being taught.
†Upper

ing seven. Fifteen, or 75 per cent, skipped from one-half to three whole-year grades (including those of the high school) after entering school; and these figures would be even higher if five of the mothers had not discouraged more rapid progress. Many of the boys and girls took unusually hard high school courses. We have already noted scholarship records in high school (Table I). It is estimated from the parents' judgments and the few available records that sixteen, or 80 per cent, of the group had excellent school marks in the grades previous, and that the four boys who did not acquit themselves so well achieved thoroughly satisfactory marks, nevertheless. Let us compare the ages at graduation from high school of the superior and median groups:[7]

| | Range | Median | Average |
|---|---|---|---|
| Superior Group ..... | 15.9-19.8 yrs. | 17.5 yrs. | 17.3 yrs. |
| Median Group ..... | 16.7-20.1 yrs. | 18.2 yrs. | 18.3 yrs. |

It is clear that the superior pupils were, on the whole, younger than those with a mental rating at the median.

Investigation of each case convinced the writer that there was ample evidence in addition to the tests that at least eighteen of the superior group were distinctly above the average in general intelligence. The other two seemed not remarkable, though there was evidence of their mental alertness. In every case mental ability was found to be general, or "all-round." However, nearly all had some special talent, or talents, such as musical, artistic, literary, or dramatic ability, though none had shown extraordinary gifts.

*Interests and Vocational Aims.* Space permits only the following more important indications from the questionnaire:

(1) The superior pupils, as a group, did not find their studies easier nor more interesting than did the median group. To a slight extent the reverse was true. Probably this was due to the fact that the college preparatory course, elected by seventeen of the former as against eleven of the latter, offered fewer electives and required subjects that made less popular appeal.

[7]See Tables I and II.

(2) In quality the extra-curricular reading of the two groups was much the same. However, difference lay in amount, the average number of hours a week for the superior pupils being 8.9; for those of the median group, only 5.1.

(3) The range of "hobbies," or interests, was somewhat greater for the superior young people, both individually and collectively, than for the pupils at the median. The superior group was more interested than the median in activities requiring brain rather than brawn.

(4) In qualities of leadership and organization, and in ability to construct and create, the more intelligent group showed some superiority to the median.

(5) As regards employment (both paid "jobs" and home duties) of the boys, it was found: (a) That employment outside the home had been of much the same nature for both groups. "Paper boy," "delivery boy," "office boy," "ranch hand," "theater usher," "factory helper," "cannery worker," "chauffeur," and "clerk" were typical terms used. (b) But that the superior group had given a little less than half as much time as the median group to outside employment. Since the average number of hours of work a day during times of employment was much the same for both groups, the total amount of employment in years can be compared in the following table:[8]

| | Range | Median | Average |
|---|---|---|---|
| Superior Group ..... | 5 yrs.–0 | 1 yr. | 1.4 yrs. |
| Median Group ..... | 8 yrs.–4 mos. | 2 yrs. | 3. yrs. |

(c) That home duties took the time of both groups about equally.

(6) Regarding employment and home duties of the girls it was discovered: (a) That the amount of paid employment outside the home was insignificant; and that the superior girls had had even less than the girls at the median. (b) The two superior girls ($33^1/_3$ per cent) who had been employed, listed caring for children and "selling electric lamps"; the four median girls (50 per cent) named "clerking" in stores, working in a cafeteria, and working in a fruit cannery. (c) All of the superior group and 62 per cent of the median group had regular home duties.

[8]To get these figures the durations of all the "jobs" of each boy were added.

(7) For neither group, taking into account both boys and girls, was there any clear correlation between past employments and future vocational aims.

(8) The two groups of boys had very similar vocational aims; and the same may be said of the girls. For the former, engineering, chemistry, and law, in the order named, were the most popular fields. The girls expressed a preference for careers as writers and musicians, though commercial work (including stenography), teaching, the stage, and other lines were mentioned.

*Conclusions.* It should be noted that this paper gives only a very brief summary of some of the facts brought out by the investigation. While no definite conclusions can be drawn with only twenty subjects, this study tends to show that:

1. Mentally superior high school pupils come from homes where conditions are favorable to right development.
2. They are generally precocious physically as well as mentally.
3. They are not below the average in general health.
4. They have less paid employment outside the home than their fellows, and spend more time in reading.
5. They have more intellectual interests, and seem to be somewhat better leaders and organizers than average young people.
6. Pupils of superior and average intelligence have very similar vocational aims.

This study cannot be compared with others of exceptionally intelligent high school pupils, for, as far as the writer knows, there are none that have attempted to get so wide a range of data. There seems to be, however, a growing interest in the "bright" child. We realize that the world needs men with brains. Detailed investigations of the mentality and development of our superior young people will lead, it is hoped, to more adequate educational provisions for them.

# A Test of Some Standard Tests

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A SURVEY of the work of a very modern type of Rhode Island school was made by the writer in 1919. This investigation was based upon the following standard tests of intelligence and efficiency: Trabue language completion, scale alpha; Thorndike's scale alpha for the understanding of sentences, Thorndike's opposites, Whipple's word-building, Thorndike's visual vocabulary, Courtis arithmetic, Series B, Form A, Kansas silent reading, quality and rate of handwriting scored by the Ayres Gettysburg scale, Ayres spelling in sentences and Ayres spelling in columns—in all thirteen tests; the opposites and word-building being primarily intelligence tests, the others, tests of school ability or efficiency. The original aim of the work was to furnish records for the school which might serve as a relatively thorough diagnosis of each individual and grade, from the point of view of standard scores, so that on the basis of these data, remedial measures might be applied where necessary. The testing of the children suggested as a by-product the opportunity of testing the tests employed, in so far as the scope of the situation permitted.

Of the two hundred pupils examined, none below the fourth grade are included in this account, and only sixty above the third grade were present at all the tests. This reduction in attendance was occasioned by the epidemic of influenza then prevalent. The scores of the sixty mentioned, therefore, furnish the data for the greater part of the investigation. The distribution of these pupils in the different grades was as follows: thirteen in the eighth, eleven in the seventh, twelve in the sixth, fourteen in the fifth, and ten in the fourth. Except in the case of a few individuals, the results of giving standard tests below the fourth grade were unreliable. Comprehension of the language of both the tests themselves and the directions for administering them, the naturally vagrant attention of young children when confronted with abstract material, and the tendency to guess the answers were stumbling blocks to consistent reactions. Performance tests, constructive and interpretive in character are needed for such work in primary grades.

In order that comparison might be made regardless of school grade, each child's score in each test was reduced to a decimal by dividing his individual score by the standard median score of his grade. If a child's score happened to be exactly the standard score, his mark was, like the Terman intelligence quotient, 100. If he received 6 where the standard was 8, the mark recorded was 75. If he obtained 9 where the standard was 6, his mark was 150. Each pupil's scores for the entire number of tests were then averaged. These general-ability-quotients based upon the results of the tests arranged in order of merit regardless of the school grade in which the pupil might be classified. For convenience of inspection this uniformity of procedure was especially advantageous, because of the widely varying score values of the different tests. For example, in Thorndike's visual vocabulary the possible scores range, approximately by units, from 4 to 11, in the Kansas silent reading by fractional steps from 2 to a total of 46, for grades 6, 7, and 8. For part 2 of Thorndike's understanding of sentences, 7 to 9, and so on. The standard scores of the different tests for any given grade, therefore, are not numerically similar. In each case, to determine the relation of a child's score to the standard requires the delay of comparison of his mark with the standard. For this reason the ability-quotients were found convenient.

Comparison with a year's actual school grades resulted in a correlation of .94 between school grades and average scores in the tests given. Teachers' estimates of the pupil's general ability also agreed almost invariably with the order of merit determined by the tests. This group of tests, therefore, furnished a relatively reliable gauge of general intelligence, if by intelligence we mean potential ability to learn, and by learning we mean the modification of behavior through experience.

The scores of the pupils of the entire school including the above-mentioned group of sixty were also averaged, in each case taking into account an individual's scores for all the tests at which he was present. (The number of the tests taken by individuals varied from three to thirteen.) The range of these averages of the large group was 59 to 150, the latter score being included in the small group, whose lowest average score was 75. The median score of the large group was 100, of the small group 96, with quartile deviations of

3.3 and 1.1 respectively, indicating that the entire school had attained relatively standard excellence, and that the small group was somewhat more compact and selected than the large group. Evidently differences in achievement in the small group had been smoothed out, as the quartile deviation includes roughly half of the measures.

TABLE I

*Results of Testing Sixty Pupils—Grades 4 to 8 Inclusive*

| Tests | Range* of Ability | Median Ability | Correlation with Average of all Tests |
|---|---|---|---|
| Ayres Spelling—sentences ..... | 7-139 | 93 | .29 |
| Ayres Spelling—columns ..... | 10-171 | 115 | .26 |
| Kansas Silent Reading ..... | 44-236 | 116 | .42 |
| Handwriting—quality ..... | 52-175 | 102 | .02 |
| Handwriting—rate ..... | 25-175 | 104 | .41 |
| Courtis Arithmetic—accuracy .... | 24-148 | 82 | .52 |
| Courtis Arithmetic—rate ..... | 75-150 | 100 | .57 |
| Kansas Silent Reading—rate ..... | 80-140 | 85 | .52 |
| Thorndike Reading—sentences .. | 0-167 | 92 | .26 |
| Trabue Completion—alpha ..... | 64-225 | 110 | .43 |
| Visual Vocabulary—Thorndike .. | 75-291 | 120 | .62 |
| Opposites—Thorndike ..... | 11-240 | 114 | .57 |
| Word Building—Whipple ..... | 33-280 | 135 | .65 |

*Range extends above and below 100 which represents standard score.

Upon the basis of order of merit, correlations were computed by the rank difference formula $r = 1 - \frac{6\Sigma D^2}{n(n^2-1)}$. Of all the tests given the poorest index of ability was found to be quality of handwriting. The correlation of this test with general average was .02. This indicated, as might be expected from the psychological processes involved, no relationship between general intelligence or ability and such a motor performance as handwriting. The next lowest correlation was found between Thorndike's understanding of sentences and general ability. Here the correlation was .26. The children's own comments testify to the fact that they found the test uninteresting in both form and content. Thorndike's visual vocabulary, on the contrary, elicited the keenest interest, and the correlation with general ability was found to be .62.

TABLE II

*Correlations with General Ability*

| | |
|---|---|
| Word Building—Whipple | .65 |
| Visual Vocabulary—Thorndike | .62 |
| Opposites—Thorndike | .57 |
| Courtis Arithmetic—speed | .57 |
| Courtis Arithmetic—accuracy | .52 |
| Kansas Silent Reading—rate | .52 |
| Trabue Completion (alpha) | .43 |
| Kansas Silent Reading—comprehension | .42 |
| Rate of Handwriting | .41 |
| Ayres Spelling—sentences | .29 |
| Ayres Spelling—columns | .26 |
| Thorndike Reading | .26 |
| Quality of Handwriting | .02 |

These results obtained from the Thorndike scales suggest that the more interesting the test the less erratic the scores. In four instances, in Thorndike's scale for the understanding of sentences, unexpectedly high scores were obtained by slow, plodding pupils whose reaction to anything out of the ordinary is usually temporary mental confusion. These same pupils obtained low scores when confronted by the visual vocabulary, the Trabue completion, and other tests which present novel features and require less restricted associative processes. Comprehension and analysis of a passage demand a different type of mental activity from adaptation to a novel situation. The latter depends primarily upon the utilization of past experience in new combinations or settings, rather than upon repetition of a practiced performance, relatively habitual or familiar, such as reading a passage and reproducing certain parts of it. It goes without saying that pupils do not exercise their best efforts in monotonous tasks.

Between general ability and Ayres spelling in columns the correlation was .26, between general ability and Ayres spelling in sentences .29. The slightly higher correlation may depend upon the fact that it requires greater mental effort to grasp both the content of the sentence dictated and the spelling of the words than merely to grasp separate words, each representing a specific habit already relatively automatic. The next correlation in order of magnitude was rate of handwriting which was .41, adding evidence to the theory that speed and intelligence are related. The correlation between quality and speed of handwriting was found to be —.12, which agrees with Starch's findings (Educational Psychology, p.

313). Since legibility of penmanship does not necessarily indicate general intelligence this result is not surprising. Kansas silent reading (comprehension) gave a correlation of .42, Trabue completion, scale alpha .43, Kansas silent reading (rate) .52, Courtis arithmetic (accuracy) .52, opposites .57 and word-building .65.

In order to obtain one general arithmetic score, the scores obtained for all fundamental operations for each individual were averaged according to the decimal method employed for the general averages. By a similar method rate scores were obtained, rate being measured by considering the median number of examples attempted as the standard for the grade under consideration.

During the same year that these tests were given to detect mental ability physical measurements of the same children were made under the direciton of Dr. Marion Weston. These measurements consisted of height, weight, lung capacity, and posture. A minus correlation was found between the average of such physical measurements, and the mental averages of the group of sixty, indicating that the physically developed individuals of the group did not happen to possess the greatest mental ability. Those, however, whose health was uniformly good enough to permit regular attendance, or whose mental resistance presented an obstacle to contagion thru influenza, made better average scores than the pupils whose attendance was so irregular as to make it necessary to be absent from some of the tests. The correlation of lung capacity with mental ability was .20, the highest of all the physical measurements considered. Weight gave a correlation of —.76.

With the omission of handwriting, the average of the correlations found between the different tests given and general average was .46, which, although low, leads one to suspect some definite relationship between this group of tests and general intelligence or ability. In every instance, of course, the probable error, according to the formula $P.E.=.67449\frac{1-r^2}{\sqrt{N}}$ is sufficiently large with a group of sixty to render the correlations less significant than their face value would indicate. For example, the P. E. of .46 for sixty cases is .068; but since r is more than four times P. E., relationship may be considered to exist.

TABLE III

*Correlations Between Tests*

| | |
|---|---|
| Kansas Silent Reading—comprehension and speed | .60 |
| Courtis Arithmetic—speed and accuracy | .55 |
| Visual Vocabulary and Trabue Completion | .43 |
| Visual Vocabulary and Word Building | .36 |
| Opposites and Word Building | .32 |
| Opposites and Visual Vocabulary | .25 |
| Kansas Silent Reading and Word Building | .24 |
| Thorndike Reading and Visual Vocabulary | .13 |
| Thorndike Reading and Word Building | .05 |
| Handwriting—speed and legibility | —.12 |
| Thorndike Reading and Courtis Arithmetic | —.27 |

Some of the intercorrelations found were as follows: visual vocabulary and word building .36, Trabue completion and visual vocabulary .43, opposites and word building .32, Thorndike reading and word building .05, visual vocabulary and opposites .25, Thorndike reading and visual vocabulary .13, Kansas silent reading and word building .24, Thorndike reading and arithmetic —.27, Kansas silent reading—rate and comprehension .60, Courtis arithmetic—rate and accuracy .55. The closest relationship was found between rate and comprehension of reading.

It is evident from this investigation that the best tests of general ability or intelligence are closely related to the use of language, which, according to the theory of "identical elements" may possess a considerable amount of transfer value. Command of language is undoubtedly a gauge of ideas. The employment of symbols of which words are an example, also indicates mental development. It seems, therefore, that a language test is a somewhat more reliable index of intelligence than is any other type of test. It is patent also that understanding of the language of any test is a fundamental condition of success in that test.

As a result of an extended period of experience in the practice and supervision of testing children, and in conducting extension courses for teachers, in the subject of tests of intelligence and efficiency, the following conclusions have suggested themselves: most of the tests present a problem too difficult for teachers untrained in the art of administering and scoring tests. Others require too much time of both teacher and pupil. Others test too narrow a limit of an individual's ability. Instead of fewer tests, however, more are needed, in order that a wider latitude of choice may be possible.

Ayres handwriting scale presents many desirable features. It affords an opportunity for auto criticism by the pupil, and therefore an incentive for improvement. Depending as it does upon legibility it emphasizes function. In these respects it furnishes a valuable teaching device. Ayres spelling scale, though somewhat intricate for beginners, commends itself through the care exercised in its derivation and standardization, and the fact that the word groups of equal difficulty are carefully graded. The Kansas silent reading test, though easily administered and scored and thoroughly objective, calls for certain arbitrary answers, perhaps a trifle too exacting. For example, the insertion of one word too many may invalidate an answer, though it is evident that the pupil understood clearly the meaning of the subject matter. The Trabue completion is desirably objective in form, and progressively graded in difficulty, permitting a wide range of achievement. The scoring, however, is very difficult for the average teacher unskilled in such work, and indeed no small problem for the experienced examiner. The Courtis tests in arithmetic, though they include only the four fundamentals, are easily administered. The directions for giving are simple and are printed on the test sheets. The results are easily scored by an answer card. Again, however, the "class record sheet" is a veritable puzzle to the novice.

As tests of intelligence, the opposites and word-building present more of a problem situation than do tests depending upon habits already acquired, such as spelling, writing, fundamental operations in arithmetic, and reproduction of material read. The search for an opposite demands the exercise of lively associative processes and selective judgment. In addition to these activities, word-building involves accurate recall and constructive imagination.

The result of a questionnaire among fifty elementary teachers indicates that from their point of view the ideal test of both intelligence and school efficiency, though like most ideals impossible of attainment, should be primarily a constructive and interpretative language test based on minimum essentials of the subjects of the curriculum. It should be so thoroughly objective in character that answers are obviously either correct or incorrect. Those open to subjective interpretation interfere with uniformity and accuracy. A test should be sufficiently brief to occasion minimum fatigue effects

on the part of both teacher and pupil. It should be so devised that pupils could correct their own papers from a key. It should consist of a considerable number of graded steps so that slight gradations of individual rank differences may be somewhat definitely determined. In finding correlations a large number of pupils with the same score cover up individual differences. This undesirable condition is more nearly obviated by the Kansas silent reading test than by Thorndike's understanding of sentences. A test should be graded from almost zero difficulty to a relatively unattainable standard, as in the Trabue completion several of the most recent group scales and many of the army tests. In this way limits may be undefined at each extreme, leaving sufficient latitude for extremes of achievement. It would be more convenient were all tests so arranged as to have all standard scores for a given grade numerically identical. A test should be simply stated and easily administered. The directions should be brief, and if possible printed on the test sheet so that the pupil may not be required to remember them, or to waste time and energy endeavoring to understand the examiner's directions. A test should be sufficiently interesting in character to seem worth while and to hold the attention of children. Such a test to determine a child's fitness for a school grade would be welcomed by busy teachers who are already too much hampered with routine detail to assume the additional burden of administering and scoring the numerous intricate tests at present in circulation. These teachers are still depending upon their own standards and requirements in the various branches of the curriculum, rather than learn the complex art of administering and scoring standard tests skilfully. Considering all that is required of the elementary teacher this attitude is to be expected. She understands her work to be primarily teaching, not testing; and until the test problem is simplified, she is not likely to appreciate the value of testing as a means of improving instruction. These conclusions have been reached through direct contact with the teachers in question.

*Conclusions:*

Of the current standard tests employed in this investigation, those involving the most language ability were the most reliable indices of general school ability or efficiency gauged by general success in the entire group of tests, by teachers' estimates of individuals, and their actual school grades in daily school work.

Of all these tests the least interesting in form to the pupil were of least diagnostic value.

The relationship between general physical and mental measurements was negative.

Of the intercorrelations between individual tests, the highest was found between comprehension and speed in reading, the next between accuracy and speed in arithmetic, the lowest between speed and legibility in handwriting.

The ideal test should present a wider range for achievement, have a larger number of graded steps, should be more objective, and more easily administered and scored than the majority yet standardized and now in circulation.

# The Reliability and Significance of Tests of Intelligence

EDWARD L. THORNDIKE

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IT IS the purpose of this article to present certain facts concerning the reliability and significance of a twenty-minute examination of the general type of the Army Alpha but so arranged that anybody can give it who will exercise the ordinary precautions used in conducting any school examination. The examination itself is not suggested for use, since we have in the Alpha, Pressey-Pressey, Otis, Virginia Survey, and the new National Research Council tests, instruments of the same general character and it is undesirable to multiply tests except to gain some special advantage.

The available facts concerning the reliability and significance of these are however somewhat meagre; and it is probable that the facts which I have to present will hold approximately true for any well-planned twenty-minute written intelligence examination.

Only so much of a description of the examination is offered here then as is necessary for proper understanding and use of the facts that follow concerning reliability and significance. It comprises 8 tests, (1) written directions, (2) arithmetical problems, (3) synonym antonym, (4) selection of the reasonable answer (5) checking the largest and the smallest number in a column, (6) completing a number series, (7) memory of pictures, numbers and irregular diagrams, and (8) verbal analogies. The candidate begins with test 1 to 0 minutes, and works without pause through all the tests, in so far as he chooses; but at various times he is told "Even if you haven't finished test 1, begin test 2 now," etc. These times are 2, 6, 8, 10, 11½, 14, and 18 min. The score is 2×r for Test 1, 2×r in first 5 problems of Test 2, 4×r for second 5 problems of 2, 1×(r—w) for 3, 2×r for 4, 1½r for first 5 of 6, 3×r for the last 5 of 6, 1×r for 7, and 1×r for 8 (in which r stands for number right, w for number wrong). The maximum obtainable is thus 145. One 4th year high school pupil out of about 200 obtained a score of 144. The median score for 257 6th grade city pupils

was 45; for 55 7th grade city pupils it was 70; for 100 adult (21-30) skilled mechanics it was 70; for 267 4th-year high-school students and college freshmen it was 100. Roughly the scores in it correspond to Alpha scores (unweighted) as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 20 min. test ... | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | |
| Alpha ..... | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | |
| 20 min. test ... | 50 | 55 | 60 | 65 | 70 | 75 | ? | ? | 100 |
| Alpha ..... | 65 | 70 | 75 | 80 | 85 | 90 | ? | ? | about 135 |

For a single trial with such a test the probable error is from 4 to $8\frac{1}{2}$ according as the score obtained is from 35 to 100. $6\frac{1}{4}$ is about one-fifteenth of the difference between the scores of a feeble-minded and a superior adult, or about 1 year of mental age.[1]

The facts whence the above determinations are derived are two trials with two different forms of the test on 146 sixth-grade pupils, 105 eighth-grade pupils, 46 adult tradesmen, 54 army officers, and 42 university students.

This is not a satisfactory degree of precision, but it is about what may be expected from a 20-minute test. A Stanford Binet score, representing perhaps a 50-minute examination, has a P. E. of about 5 months of mental age, and an Army Alpha taking some 40 minutes has a P. E. of about $5\frac{1}{2}$ (unweighted) points.[2] This is about one-twentieth of the difference between the scores of a feeble-minded and a superior child or about $\frac{3}{4}$ year of mental age.

It thus appears that an examination of twenty to fifty minutes, whether oral or written, is adequate to make with surety only coarse distinctions among individuals. It is adequate, if properly used, to decide whether an individual should be examined further with respect to any practical issue, such as commitment to an institution, or promotion in school, or employment at a certain job. Proper use means among other things to re-examine all those within 3 or 4 P. E. of the crucial line. The custom of passing all those whose scores are slightly above the crucial line seems extremely dangerous.

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[1] I take this opportunity to correct the obvious error on p. 31 of Vol. III of This Journal, where P.E. is stated to be a certain quantity $\times \sqrt{2}$ instead of $\div \sqrt{2}$, and to apologize for my own careless proof-reading.

[2] The Probable Error of the Stanford Binet is as computed by Otis from the scores in the two halves of the examination. The probable error computed from the correlation between the Stanford Binet and another examination of the same type might, of course, be greater.

The question concerning the significance of the test upon which I have data is substantially, "Do verbal and non-verbal examinations measure the same mental ability?" The answer being that they do not, the further question arises concerning the magnitude of the difference. If they measure the same ability, the correlation between the scores for the same individual in the two examinations will, when corrected for attenuation, be 1.00, or vary around 1.00 as a central tendency. Any shortage below 1.00 is a measure of the magnitude of the difference between the abilities.

The facts are as follows: The raw correlation between two-thirds of the test described and the Thorndike non-verbal test in the case of 108 6th grade pupils is .52. The self correlation of the test described is probably above .70 and almost certainly is not under .60.[3]

The obtained self-correlation for the two-thirds of the Thorndike non-verbal examination is .76. The correlation between verbal and non-verbal when corrected for attenuation is thus presumably .71 and almost certainly not over .83.

The raw correlation between the examination described here and the Thorndike non-verbal in another group of 147 6th grade pupils is .435. The self correlations are .68 and .89. The correlation between verbal and non-verbal, when corrected for attenuation, is thus presumably .56 and almost certainly not over .67.

The raw correlation between this examination and the Thorndike non-verbal in a group of 46 enlisted men of wide variability is .76, the two self correlations being .85 and .91. The correlation corrected for attentuation is thus .86.

The same raw correlation in a group of 43 commissioned officers is .28½, the two self correlations being .40 and .49. The correlation corrected for attenuation is thus .64.

The raw correlation between the Army Alpha and two-thirds of the Thorndike non-verbal in the case of 108 sixth-grade pupils is .47. The self-correlation for Alpha was not determined in this group but almost certainly would not be less than .75, since Alpha correlates with the examination described in this article in this group to an extent of .75. The self-correlation for the two-thirds of the

[3]This examination correlates with the Army Alpha in this group of cases to an extent of .75. For a different group of 147 6th grade pupils its self correlation is .68. For 31 8A pupils it is .46. For 44 8B pupils it is .59. For 46 adult enlisted men it is .85. For 43 commissioned officers it is .49.

Thorndike non-verbal is .76. So the corrected correlation is presumably about .60 and is almost certainly not higher than .70.

The raw correlation between the Army Alpha and the Thorndike non-verbal in the case of the 46 enlisted men is .79. The two self correlations are .95 and .91. The corrected correlation is thus .86. For the 43 commissioned officers the corresponding facts are .36, .95 and .40, and .58.

In general the examination described here or the Army Alpha correlates with the Thorndike non-verbal slightly less than .7, correction for attenuation being made (.68½ ± P.E. of .03).

This estimate is further supported by the raw correlations in certain groups where the data do not permit correction for attenuation. Thus in 169 fourth-year high-school pupils the correlation between the examination and the Thorndike non-verbal is .49. In 12-year olds (colored) in grades 6, 7 and 8, it is .54 (n=31). In 13-year olds (colored) in grades 6, 7 and 8, it is .59 (n=49). In 14-year olds (colored) in grades 6, 7 and 8, it is .49 (n=50).

Intelligence as measured by the one kind of instrument then seems to be something very different from intelligence as measured by the other. This is due probably largely to the difference between verbal and non-verbal content, but partly also to the greater weight attached to speed in the verbal test. With its explanation, however, we are not here concerned. The primary fact is that intelligence is not one thing but many. The abilities measured by a speed test with language and mathematics are not identical with, or even very similar to, those measured by a test with pictures and less exacting in speed.

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## EDITORIAL

*Educational Measurements and the Teacher*

"Educational measurements may be the last word in school procedure," said Miss Winthrop, teacher of the 5A grade, as she entered the principal's office, "but I do not see that they have anything to offer me as a class-room teacher. Here I have been working for hours, scoring and tabulating the Thorndike reading tests, but what do I get out of it when I have the work completed?" "This is not the first time that I have heard that question," replied the new principal, motioning her to a seat, "and I shall be greatly interested to hear what you have to say about it. Your implied criticism of the measurement movement is a serious one, for if such work fails to benefit the classroom teacher it may persist for a time as a fad, but it is not likely to have any permanent influence upon education. We may talk all we like about school organization, administration and supervision, but the real work of education is done in the classroom. All the other activities are justifiable only in so far as they make the work of the classroom easier and more efficient."

"I am glad to hear you say that," rejoined Miss Winthrop "for it goes right to the heart of my difficulty. Instead of making the class work easier, measurements only seem to add to my already heavy burden of clerical work. I have papers to mark, and records to keep, and any number of blank forms to fill out. This work takes time, and is not sufficiently attractive to make the prospect of its increase at all agreeable. I like to teach, but the keeping of records is the merest drudgery. Now it seems to me that measurements will involve vastly more record keeping than before, and there is no end to the amount of manipulation that these records may be subjected to. However, I should not object to a considerable increase in distasteful clerical work, if I felt that the outcome justified the effort. This is where I am in doubt. Suppose I have a record of the score of each pupil in the Thorndike reading tests, the Monroe arithmetic tests, the Starch problem test, the Ayres spelling scale, the Hahn-Lackey geography scale, the Bell-McCollum history tests, and so on, what am I going to do with it: My class goes on just the same. That pupils in the same class show striking differences in ability I knew before. But if the class is to progress as a unit my task is to eradicate these differences as much as possible, to hold the bright pupils back and spur the dull ones on, and thus to make the group as homogeneous as possible. How, then, do measurements help me in teaching my class?"

"The questions you raise," replied the principal, "would require much more time than we have this afternoon, if we should consider them in detail. Let me merely make two or three suggestions. It is true that at the present time the class is the unit of instruction. By far the greater part of the teacher's time is spent in "teaching her class.' Many insist that this is the most important thing that the teacher can do. So long as this is the goal, the chief significance of measurements for the classroom teacher is to show her how her class stands with reference to other classes, and how closely grouped or widely divergent her pupils are. After this information is gained she knows no better than before what she should do about it. The class may stand high, but perhaps it ought to stand high, even higher than it does. It may stand low, but perhaps there are good reasons why it should stand low. Perhaps but for the persistent, intensive and consecrated efforts of the teacher it would stand much lower than it does now. To take a set of measurements and attribute praise or blame to the teacher for the high or low standing of the class is not only unjust but misleading. We need at least

two measurements separated by a considerable interval of time to warrant any conclusion as to the teacher's influence on a class. The class may be widely scattered or closely bunched, but in neither case is it likely that the teacher is responsible, nor will she be able to make much change in the conditions even after she has discovered them.

"But is class instruction the highest aim of the teacher? Studies of the learning process show that learning is a highly individual matter. Does not the teacher 'teach her class' too much? Should we not cease trying to drive forty pupils abreast, and endeavor to devise methods of stimulating individual pupils to put forth effort commensurable with their abilities? In that case we need accurate diagnosis of individual attainments. It is here that measurements are of the greatest assistance, in securing an objective evaluation of the attainments of the pupil as evidences of strength or weakness in various lines of endeavor. From this data 'profiles,' or pegagogical pictures, can be constructed which may be of the greatest value in encouraging or stimulating the pupil to greater exertions.

"That this will require more detailed and extensive bookkeeping is unquestionable. We need to devote a great deal of time and thought to devising simple and easily applied scales and tests. Meantime the teacher herself can do much to reduce the labor of scoring and recording the results of tests. Most of the standard tests can be scored by the pupils themselves in the fifth and higher grades. After the test let the papers be collected and redistributed indiscriminately, so that no pupil knows where his paper goes. The teacher reads the correct answers and the pupil marks the paper correct, incorrect or partly correct, according to the scoring indicated. Let the pupils interchange papers and the teacher read the correct answers again, the second pupil checking the work of the first. In this way an entire set of papers can be scored with a high degree of accuracy in about twenty minutes. In like manner the pupils can be enlisted to tabulate the results, and by dividing up the work and having them check each other, an extensive tabulation can be completed in a short time. Thus most of the bookkeeping can be delegated to the pupils, much to their benefit and delight."

"I admit," said Miss Winthrop, "that this puts the subject of measurements in a somewhat different light, and I shall be much interested to see how well my pupils can do the scoring and tabulating, and to what extent I can use the results to individualize my instruction."

J. C. BELL.

# NOTES AND NEWS

The general topic of the meeting of the New York Society for the Experimental Study of Education on April 9 was "Problems in the Teaching of Mathematics." The speakers of the evening were John C. Stone, Montclair State Normal School, "Socializing Elementary Arithmetic," and Professor David Eugene Smith, Teachers' College, "Mathematics in the Junior High School."

At the meeting of the New York Branch of the American Psychological Association, on April 26, the following papers were presented: "The Intelligence of Troops Infected with Hookworm," by Garry C. Myers; "Preliminary Report on the Thorndike College Entrance Examinations as Applied to Columbia University Freshmen," by Ben D. Wood.

At the annual meeting of the American Psychological Association at Cambridge in December, a Section of Clinical Psychology was formed. The members of the American Association of Clinical Psychologists established two years previously were constituted the initial membership of the new Section, this association disbanding by its own action. The Section was organized with Dr. Francis N. Maxfield as Temporary Chairman and Dr. Augusta F. Bronner as temporary Secretary. To be eligible for membershipp in this Section the candidate must, beside being a member of the American Psychological Association, have as a minimum requirement: (1) The Ph. D. degree in psychology; (2) A record of special preparation in some field of clinical psychology; (3) Published or prepared for publication a constribution of importance to the literature of mental tests or of clinical psychology; (4) A part of the applicant's time must be regularly devoted to making clinical examinations in psychology; (5) Especially qualified persons, not eligible under No. 1 who have fulfilled other requirements and have done distinguished work in clinical psychology, may be eligible for membership. Nominations for membership, signed by two members of the Section and accompanied by information in regard to the candidate's qualifications should be sent to Dr. Rudolph Pintner, Ohio State University, Columbus, Chairman of the Committee on Membership.

The report of the committee of the American Psychological Association on qualifications for psychological examiners and other

psychological experts has been mimeographed and sent to members. The report recommend sthat the Council appoint a permanent committee of five members to issue certificates to qualified "consulting psychologists." The requirements in theoretical training, in professional technique, and in technical information are given in some detail. At the annual meeting last December it was voted after an animated discussion that the report be accepted, the committee discharged, and a committee of five members be appointed to consider methods of procedure for certifying consulting psychologists. This committee is preparing an extended report on federal and state methods of certification, legal aspects of certification, methods of issuing certificates, and training and qualifications of consulting psychologists.

Dr. and Mrs. Sidney L. Pressey have recently complete norms, with distribution tables, for their "Primer" and "Cross-Out" scales. These norms are based upon nearly 1000 cases per grade, and may be considered reasonably satisfactory. A large survey, now under way, is expected to add 40,000 cases shortly. These investigators have also devised a Scale of Attainment in reading, arithmetic and spelling for the second grade. The scale includes four tests, can be applied in twenty-five minutes, and the papers can be scored at the rate of one per minute. This scale should prove a valuable supplement to the "Primer" scale of intelligence. The latter has proved so popular that over 55,000 copies have been sent out within the last eight months.

The Thurstone Intelligence Test for College Freshmen and High School Seniors has been given to 27,251 students in colleges and normal schools during the past year. The test contains 168 short problems of five or six different types arranged in cycle formation. Thirty minutes are allowed for the test, and the papers may be scored with stencils at the rate of about twenty per hour. No oral instructions are given by the examiner, as they are all printed in the examination pamphlet. Information regarding the test may be obtained from Professor L. L. Thurston, Carnegie Institute of Technology, Pittsburgh, Penna.

Superintendent Ernest C. Witham has recently issued a Standard Geography Test for Europe. The test contains an outline map of Europe on which the pupils are to write letters corresponding to the names of fifteen countries, the numbers of fifteen cities, the

numbers of five seas, the names of five mountain ranges and five rivers. The pupils are also asked to indicate the chief industries and products of ten countries.

The organization of the Wisconsin Association for Educational Research indicates the rapidly growing interest in the study of quantitative as well as qualitative problems of education on the part of the school men of Wisconsin. The personnel of the association includes representatives from practically every field of educational work in the state. Teachers, supervisors, superintendents, members of normal school and university faculties who are studying educational problems are the charter members of the society. The purpose is not only to encourage the scientific study of educational questions but to keep the members closely in touch with what each is actually doing in the way of educational investigation and experimentation. By means of a bulletin issued at regular intervals the members can announce intensive studies and ask for co-operation or for the results of similar studies completed or under way by other members in the same or similar subjects. They can learn definitely and economically to whom to go for specific information and can avoid a repetition of unnecessary effort. The state department of education in Wisconsin, is well represented in this group. Dr. W. W. Theisen and Mrs. Cecile White Flemming, supervisors of educational research in the state department have been influential in the formation of the organization. The officers for the year 1919-20 are Supt. C. J. Anderson of Stoughton, president; Cecile White Flemming, state supervisor of educational measurements, secretary-treasurer.

Another evidence that Wisconsin school men are keenly interested in scientific study which makes possible the improvement of the tools and practice of education is the addition of a section on educational measurements to the list of meetings held by the Wisconsin State Teachers' Association and also by the Southern Wisconsin and other sectional state teachers' associations. These sectional meetings have in each instance been largely attended. The growth of the scientific spirit in education within the state is shown by the appearance on the program of local superintendents and supervisors with their discussions of test results in the various school subjects for the improvement of methods of instruction; and their emphasis upon the value of group intelligence tests for the

sectioning of pupils on the basis of ability and the adaptation of materials and methods in accordance with individual pupils' needs.

Professor Edgar Riley, Principal of the Training School in the state normal, Platteville, Wis., is chairman of the Educational Measurements section of the Wisconsin State Teachers' Association. Mrs. Cecile White Flemming, State Supervisor oof Educational Measurements is secretary of the section.

The University of Manchester, England, announces the establishment of a library for deaf education at that institution by the Carnegie United Kingdom Trust. It is intended to make this library as comprehensive as possible, and to include in its works dealing with the various systems of teaching the deaf, speech training, psychology of speech and of hearing, phonetics, acoustics, and the anatomy, physiology and diseases of the ear. The books will be available to all individuals, societies and institutions throughout the United Kingdom.

Dr. Lotus D. Coffman, head of the department of education at the University of Minnesota, has been elected president to succeed Dr. Marion L. Burton, president-elect of the University of Michigan.

Dr. James Rowland Angell, professor of psychology in the University of Chicago, this year chairman of the National Research Council, has been elected president of the Carnegie Corporation of New York.

Dr. Henry W. Holmes, professor of education, has been appointed dean of the Harvard Graduate School of Education.

Mr. Engene A. Nifenecker has been elected director of reference, research and statistics by the New York City Board of Education.

# PUBLICATIONS RECEIVED

THERESA BACH. *Educational Changes in Russia.* Washington: Bureau of Education, Bulletin, 1919, No. 37. Pp. 26.

The most of the data for this Bulletin come from the official records of the early days of the revolution in 1917, but some account is taken of tendencies during the year 1918. The outstanding features of the report are the complete secularization of the schools local responsibility for and control of the schools (now in the hands of the local soviets), the abolition of all restrictions on national or religious groups, spelling reform, government control of textboks, and the opening of new universities (badly used under the soviet regime).

WILLIAM T. BAWDEN. *The Army Trade Tests.* Washington: Bu-
*of Function of Disabled Joints.* Washington: Walter Reed Hospital, 1919. Pp. 67.

The monograph presents an exposition of the aims of occupational therapy, typical asignments to shops, measurement of the range and strength of voluntary movements (with charts showing improvement with treatment), type studies of movements occurring in occupational activities, peripheral nerve palsies, a list of tools of special curative value, and a study of type cases. An appendix gives an outline of the psychological service that can be rendered in a hospital.

WILLIAM *T. BAWDEN. The Army Trade Tests.* Washington: Bureau of Education, 1919. Pp. 28.

This is the report of a conference of specialists in industriai education, called by the United States Commissioner of Education to meet at St. Louis, February 19, 1919. The monograph contains the addresses of Lieut. Col. A. C. Strong, Jr., on "Army Personnel Work," describing the task of personnel organization, the classification of soldiers, the army trade specifications, trade tests, and the classification and rating of officers; of Lieut. Col. W. V. Bingham on "Development and Standardization of the Army Trade Tests," giving the sources of test material, the oral tests, the picture tests, and performance tests in certain trades; and of Lieut. Col. J. J. Swan on "Possibilities of Use of Army Personnel Methods in Industry."

Col. Swan gave a sketch of the development of employment methods, spoke of the task of standardizing human intellect, of the need for analysis and definition of tasks, of the development of

trade tests by each industry and each shop, and of the expense involved.

LIEUT. COL. W. V. BINGHAM. *Measuring a Workman's Skill. The Use of Trade Tests in the Army and Industrial Establishments.* Reprinted from Bulletin No. 30, National Society for Vocational Education, 1919. Pp. 12.

"While these trade tests were being developed, two astonishing discoveries came to light. The first of these is the rarity, the practical non-existence, of the exclusively motor-minded type of tradesman, the man who can do the job with his hands but cannot tell you about it in words. In beginning the trade test development we had expected to meet numerous difficulties due tothe prevalence among manual laborers of this variety of mental constitution. We expected to find that the oral type of tests would prove useful with the more verbally minded men; but we anticipated meeting many tradesmen of high proficiency and skill who could do little or nothing with these oral questions. This expectation proved to be wholly at variance with the facts. The problem here suggested, as to whether the so-called pure type of motor-mindedness is really only a mythical abstraction, is respectfully referred to the laboratories of educational psychology. The other discovery, not wholly unrelated to the first, was the fact that in a majority of the trades the oral tests yielded more accurate differentiations of proficiency than did the performance tests. In other words, the journeyman and the expert differ from the apprentice not so much because they have greater manual skill and dexterity as because they excel in judgment, technical information, or trade knowledge."

HERBERT ERNEST CUSHMAN. *A Beginner's History of Philosophy. Vol. II. Modern Philosophy.* Boston: Houghton Mifflin Company, 1919. Pp. xxi, 407. $2.00.

A revised and much expanded edition of a work which first appeared in 1910. The book is written primarily for students, and is a history of philosophy upon the background of geography and of literary and political history. The time covered in this volume is from 1453 to the present. There is an especially interesting chapter on the philosophy of the nineteenth century which is illustrated with helpful charts and diagrams.

EDGAR A. DOLL. *The Average Mental Age of Adults.* Reprinted from Journal of Applied Psychology 1919. Pp. 317-328.

Hitherto the average mental age of adults has been taken as 16, and the I. Q. has been determined on this assumption. From an

examination of the intelligence ratings in the army, and from studies on several groups of defective delinquents the author believes that this age is quite too high, and that 13 is nearer the actual adult mental age. In the army it was found desirable to employ different mental age standards for negroes and foreign-born from those used with native whites. If this represents a real difference, it raises an important question for experimental psychology to investigate. If the prognostic value of mental ages is not constant for the diffent races, psychology should certainly aim to discover the reason.

*Fourth Report of the Committee on Economy of Time in Education.* The Eighteenth Yearbook of the National Society for the Study of Education. Part II. 1919. Pp. 123. $1.00.

This is the report of the sub-committee on economy of time in learning, of which Professor Ernest Horn, University of Iowa, is chairman. The monograph contains the following reports: "Principles of Method in Teaching Writing, as Derived from Scientific Investigation," by Frank N. Freeman; "Principles of Method in Teaching Reading, as Derived from Scientific Investigation," by William S. Gray; "Principles of Method in Teaching Spelling, as Derived from Scientific Investigation," by Ernest Horn; "Principles of Method in Teaching Arithmetic, as Derived from Scientific Investigation," by Walter S. Monroe; "The Present Status of Drawing with Respect to Scientific Investigation," by Fred C. Ayer; "The Role of a Consulting Supervisor in Music," by Carl E. Seashore.

MAURICE B. HEXTER. *The Newsboys of Cincinnati.* Studies from the Helen S. Trounstine Foundation, Cincinnati, Ohio, Vol. I, No. 4, 1919. $0.50.

It appears from this investigation that the percentage of delinquency among newsboys is much higher than among other boys of the same age. One-third of the delinquent boys brought into the Court of Domestic Relations, and one-third of the boys at the Opportunity Farm are newsboys, although such boys form only about one-tenth of all the boys at these ages. Newsboys are twice as much truant as other boys are. The delinquency of newsboys is an inevitable consequence of the associations into which their work throws them.

DAVID SPENCE HILL. *Results of Intelligence Tests at the University of Illinois.* Reprinted from School and Society, Vol. 9, 1919. 542-545.

The Army intelligence tests were given simultaneously to almost 3500 students. The medians for different groups of students ranged between 140 and 150. There was no clear difference in score for the different college classes. Of the various schools the law and the graduate schools were appreciably the highest, the medians ranging from 150 to 160. The medians for men were in all schools and classes from 4 to 13 points higher than for women.

ARTHUR W. KALLON. *Arithmetic. Practice Exercises in Common Fractions.* Boston: School Document No. 3, 1919. Pp. 37.

These practice exercises are based upon the errors which the tests in common fractions given in the Boston schools have shown to be common. The bulletin consists of four parts, one each for addition, subtraction, multiplication and division of fractions. Only fractions having a denominator less than 16 have been used throughout. There are fourteen distinct types in addition of fractions, thirteen in subtraction, eleven in multiplication and ten in division. Forty examples are given illustrating each type.

E. A. KIRKPATRICK. *Studies in Psychology, by Student Teachers for Teachers in Training and Service.* Boston: Richard G. Badger, 1918. Pp. 194. $1.50.

The author has for many years followed the "project method" in teaching psychology to his classes. With each class some special project would be chosen, and the entire class would work on the development of that project. The present book gives the results of eight of such project studies, including habit, memory, imagination, attention, concepts, perception, feeling, and will. It is a stimulating and suggestive little book, and as it is the direct outgrowth of the work of the classroom it should prove helpful to many teachers of psychology in normal and teacher training schools.

CLINTON P. MCCORD. *Physical and Mental Condition of Delinquent Boys.* Reprinted from Albany Medical Annals, April, 1919. Pp. 15.

An interesting feature of this paper is a comparative chart of leading defects based on the examination of 100 boys at the Berkshire Industrial Farm, and of 1000 fifth grade boys of the Albany

public schools. Sixty-six per cent of the delinquent boys are afflicted with nasal catarrh and chronic pharyngitis as compared with seventeen per cent of the school boys. Lateral curvature shows thirty-one per cent among delinquents compared with thirteen per cent among normals. Other striking differences are in mental deficiency, delinquents eleven per cent to normals two per cent; in discharging ears five per cent to one per cent; and in rachitic remains eight per cent to one per cent. On the other hand the school boys showed nine per cent glandular defects compared with only one per cent among the delinqents. In decayed teeth, defective vision, diseased tonsils, malnutrition, defective hearing, and skin defects the percentages are about equal.

JOHN BACH MCMASTER. *Brief History of the United States.* Revised and Enlarged. Cincinnati: The American Book Company, 1918. Pp. 466, xxx.

The author has held to the plan of putting in the body of the text only those statements that are essential to the development of the narrative, and introducing interesting supplementary matter in the form of copious notes, which sometimes take up half the page. There is an abundance of splendid maps, and interesting illustrations are found on almost every page.

NORAH H. MARCH. *Towards Racial Health.* New York: E. P. Dutton and Company, 1919. Pp. xiii, 320. $2.00.

This is an English book, whose sub-title is "A Handbook on the Training of Boys and Girls, Parents, Teachers, and Social Workers." It is a general discussion of sex hygiene, and, as is usual with English books of this character, the facts, dangers, and judicious handling of sex are treated with such deftness and delicacy that even the most sensitive will have no cause to blush. The book is religious in tone and endeavors to develop ideas of sex in accord with the highest ideals of life.

HENRY RUTGERS MARSHALL. *Mind and Conduct.* New York, Charles Scribner's Sons, 1919. Pp. ix, 236. $1.75.

This book grew out of the Morse lectures delivered at the Union Theological Seminary. The argument is in three parts. Part I, The Correlation of Mind and Conduct, deals with consciousness and behavior, instinct and reason (including instinct-actions and adaptation, and instinct-feelings and intelligence), and the self. Part II, Some Implications of the Correlation, considers creative-

ness and ideals, and freedom and responsibility. Part III, Guides to Conduct, treats pleasure and pain, happiness, and intuition and reason. Two appendices discuss the causal relation between mind and body, and the nature of outer-world objects.

LILLIAN J. MARTIN. *The Training of the Emotions.* California: Society for Mental Hygiene, Publication No. 4. 1919. Pp. 7.

The emotions of fear and rage are exaggerated and exhausting reactions which have no place in modern life, and should be brought under control. To assume the expression of rage or fear is to cultivate and develop them. When afraid, psychology says: take the bodily position that is its opposite—relax, breathe out, imitate the position of courage—and the fear will tend to disappear. Directing the attention to any emotion intensifies it, while diverting the attention decreases it.

EDWARD J. MENGE. *Backgrounds for Social Workers.* Boston: Richard G. Badger, 1918. Pp. 214. $1.50.

This book presents a scientifically trained Roman Catholic's reaction to such questions as socialism, educational aims, moral standards, birth control, sterilization, sex-instruction, eugenics, and the status of the family in primitive medieval an drenaissance times. That the author is well read and shows skill in presenting his arguments must be admitted. It is remarkable, however, what a massive effect can be produced by extracting just those aspects of another's argument that will suit one's own ends. We are far from implying that the author is not honest. The intensity of his convictions is so great that he can see only that phase of life which agrees with them.

W. R. MILES. *The Sex Expression of Men Living on a Lowered Nutritional Level.* Reprinted from the Journal of Nervous and Mental Diseases, Vol. 49, 1919. Pp. 208-224.

It seems to be the general testimony of the twenty-four young men who were engaged in the experiment of living on two-thirds to one-half their normal diet that the lowered food consumption decreased sexual desire and sexual reactions of all kinds.

The author concludes that any dietetic regime which definitely lessens the expression of the sex instinct, causing one sex to take but little interest in the other, would seem to be disadvantageous to the species if indefinitely prolonged. On the other hand the results clearly indicate a method of treatment for achieving restraint of sexual tendencies in pathological cases of sex dissipation.